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ABSTRACT

This book presents a series of conference papers dealing with educational technology. The papers are: "The Role of Educational Technology in Upgrading Teacher Education in Pakistan" (M. Hashim Abbasi and Alex C. Millar); "Report on the Teaching and Learning on the Internet Project--RMIT TAFE" (Laurie Armstrong); "A Dissemination Strategy for Student Adoption of Internet Services" (Roger Atkinson and Geoff Rehn); "PC Based Video on Demand Trials" (Philip Branch and Jennifer Durran); "Getting the Job Done: Distance Learning in the RAAF" (J.R. Dolan); "Distance Teaching With Vision" (Roger Edmonds); "Profiling Computing Coordinators" (Sigrid Edwards and Allan Morton); "Exploring the Multimedia Landscape from a Training and Professional Development Perspective" (Rae Fankhauser and Helmut Lopaczuk); "An Implementation of Interactive Objects on the Web" (Paul Fritze); "EdMOO: One Approach to a Multimedia Collaborative Environment" (Bernard Holkner); "Appropriate Media Versus Multimedia" (G. Kistan (Chandru)); "Factors Affecting Teachers and Trainers in the Use of a Bulletin Board System" (Kar-Tin Lee); "Determining the Scope of Online Delivery at a Traditional Research-Based University" (Jon Mason); "A Combined Video and CAL Package on Advanced Level Library Skills for Open Learning Students" (Iain McAlpine); "A Qualitative Study of Leaning from CAL Programs in Two Tertiary Education Courses" (Iain McAlpine); "Telematics for Higher Order Learning: Challenges and Opportunities" (Catherine McLoughlin); "Establishing Distance Education Networks in New Zealand: Policy Parameters" (Tim McMahon); Establishing Distance Education Networks in New Zealand: Practicalities Past, Present and Future" (Carol Moffatt); "Factors Affecting the Integration of Computers in Western Sydney Secondary Schools" (Allan Morton); "Live Interactive Television" (Ron Oliver and Catherine McLoughlin); "Approaches to Research in a Digital Environment--Who Are the New Researchers?" (Michael Orr and Rae Fankhauser); "Events Management Education Through CD-ROM Simulation at Victoria University of Technology" (Marcia Perry and others); "The Instructional Design Transition from Distance to Flexible Delivery Materials" (Grahame Ramsay); "Designing CBE for Continuing Professional Education" (Keith Rees); "Electronic Classrooms and Lecture Theatres: Design and Use Factors in the Age of the Mass Lecture" (Geoffrey A. Roberts and Philip M. Dunn); "Reconceptualising Pedagogy: Students' Hypertext Stories with Pictures and Words" (Glenn Russell); "Automatization of Student Assessment Using Multimedia Technology" (David Taniar and Wenny Rahayu); and "Perspectives on the Place of Educational Theory in Multimedia" (Martyn Wild). (AEF)

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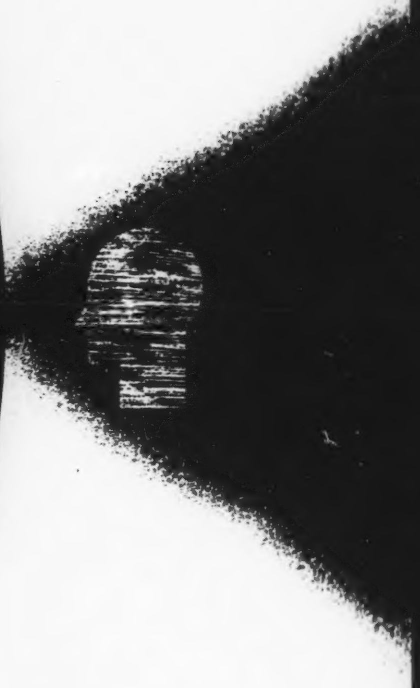
LEARNING TECHNOLOGIES
PROSPECTS AND PATHWAYS



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Selected papers from EdTech'96
Biennial Conference of the Australian Society for Educational Technology
University of Melbourne 7-10 July 1996

Edited by
John G Hedberg, James R Steele and Sue McNamara
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The Role of Educational Technology in Upgrading Teacher Education in Pakistan

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Pakistan

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International Educational Technology Consultant

This paper will outline a major joint Asian Bank/Pakistan ministry of Education project designed to solve one of the most serious of problems, in education in Pakistan through upgrading the state of teacher education, and the quality, status and professional self-esteem of Pakistan's teachers. A multi-faceted approach to the problems has been taken in this US$71m. project, one of the three or four major components of which is Educational Technology (ET). The project will be outlined by the Project Director, and then the Total Educational Technology Plan (TETP) will be summarised. At this early stage of the Project, the approach to this paper must, of necessity, be descriptive, with the opportunity of a more evaluative perspective not being possible for at least another two years when the Project is due to be formally completed.

As with a number of developing countries, the state of education and teacher education throughout Pakistan generally, has many problems. The major challenges include:

- insufficient schools and teachers;
- poor overall enrolment and participation rates generally, particularly in rural areas, amongst girls and at secondary school level; and
- extremely scarce educational resources such as textbooks and instructional media hardware and software.

The Project

The Joint Pakistan Ministry of Education/Asian Development Bank Teacher Training Projects (1993-98) is currently one of the biggest of a number of donor assisted projects designed to improve education in Pakistan. Some of the factors that have weakened Pakistan's education system include:

- an unsteady economy which has a limited manufacturing export industry base, coupled with a very high unemployment rate and widespread poverty, particularly in rural areas;
- a large and remote rural area with limited infrastructure such as roads, rail and quality electricity and water services;
- cultural and historical factors that have combined over the centuries to limit the importance and opportunities of education for girls in Pakistan society;
- a continual national emergency situation with India, focused mainly on the disputed territory of Kashmir, and the consequent high national budgetary priority that must be accorded to Defence, at the expense of portfolios such as education; and
- the population of Pakistan is increasing annually at the rate of 31%.

The philosophy underlying the Teacher Training Project (TTP) is that the single most restricting factor limiting improvement in education in Pakistan, is the comparatively poor quality of both teachers and teacher training in Pakistan. The ADB TTP has identified a number of strategies designed to form a strong foundation for a healthy teacher education system. It may be of interest that the Pakistan Education system is not unlike that of Australia, with a strong national influence in education, and the four provinces having considerable operational autonomy.

Strategies

The main strategies identified by the Project for priority attention are as follows:

1.1 Structural changes through the creation of four new types of teacher education institutions (TEI) in each of the provinces:

   1.1.1 **The Provincial Institutes of Teacher Education (PITE's)** which are to be the flagships of TE within each province for establishing and maintaining professional standards. Clearly this leadership role will extend from TE policy catering for the needs of the Province, to assisting the existing institutions with their respective roles, and to facilitating the implementation of the Total Educational Technology Plan (TETP).

   1.1.2 **The Training Outposts (TO's)** of which there are to be 66 across the country, are to be two room centres attached to existing schools, mainly in remote rural areas to cater particularly for female teacher trainees. It is intended that the TO's will provide for both pre and in-service education.

   1.1.3 **Mobile Training Units (MTU's)** of which there will be two per province, crewed by an Educational Technology Specialist (ETS)/cum trainer and an AV Technician. The roles of the MTU's will include linking the TO's with the PITE's, eg, through delivering AV and distance learning materials ordered by the TO's , maintaining AV equipment, conducting ET and distance learning training programs and acting as Outside Broadcast Units, to extend the production capability of the PITE's.

   1.1.4 **Model Government Colleges for Elementary Teachers (GCET's)** eight of which will be established to serve as models for existing GCET's (for training primary and elementary teachers), and Government Colleges of Education (GCE's) for the training of secondary teachers.

1.2 The improving modernising of the main TE pre and in-service courses, a process designed to not only produce courses based on sound rationales and goals, but which will prepare a teaching service to take Pakistan into the 21st Century.

1.3 The increased output and improved standard of teachers at all levels, particularly female teachers in remote rural areas. The strategy will need to significantly improve the quality and quantity of teacher graduates, but will need to be accompanied by significant salary increases and career structures for teachers, as well as the establishment of large numbers of new schools. All of these improvements will help raise the status of the teaching profession.

1.4 The development and implementation of a Total Educational Technology Plan (TETP) . This component regarded as a critical ingredient for success of the Project, will be dealt with in more detail later in this paper. Evidence of the importance of ET may be seen in the allocation of US$3m for hardware and US$7m — $10m for the production and acquisition of instructional material.

1.5 The upgrading and strengthening of existing Government Colleges for Elementary Teachers (GCETs) and Government Colleges of Education (GCEs). This will be assisted by the new model GCETs in conjunction with the PITEs and through the intensive training of Master Trainers who will work in these institutions.

1.6 The Project is being managed by a Federal Co-ordination Unit working in conjunction with Provincial Implementation Units, both groups being under the leadership of the Project Directors and Managers. The main academic and professional inputs are the responsibility of a Technical Panel on Teacher Education, supported by the expert advice of international and local specialist consultants.

1.7 Other features of the Project are the conducting by each Province of a number of action-based research studies, and the involvement of UNICEF in regard to non-formal teaching materials for the education of mothers and girls currently outside the school system.

Educational Technology and the Project

As indicated above, Educational Technology (ET) is a key Project element designed to assist in achieving the Project's major goals and objectives. Experience in many countries, both developing and developed, has shown that ET is capable of enhancing education and learning at the macro and the micro level. However there is at least as much evidence to show that the use of ET does not guarantee success. In other words, although there can be spectacular successes derived from the astute use of ET, there can also be spectacular ET failure stories. The question that requires addressing is "Why is ET successful in some cases and not so in others?"

Anyone who has been a keen ET practitioner and careful observer of the ET process, will at least be confident that ET is a complex matter, and that there are of necessity many criterial factors that can determine whether or not ET is going to make a positive contribution to an educational system or simply finish up as a waste of a great deal of money. Approaching a challenge such as this Project, it is essential to firstly identify the criterial factors, as well as those factors likely to negate chances of success, if not attended to. Thus a systematics and scientific approach must be used, because if there is a rough formula that is relevant, it is that all criterial factors must be operational for success to be achieved, but it needs often only one negative factor to negate the effect of ET.

Needs Analysis (NA)

The starting point in such a process must be a thorough NA, which must analyse both the macro or general scene as well as the micro or grass roots level, in order to identify characteristics which might provide vital clues as to which approaches and techniques are likely to lead to success, and which factors may lead to failure if not controlled. The results of the Project NA are as follows:

2.1 **The Target Population** — Very useful data on the school population in Pakistan is available through the data below. Although no formal survey of Teacher Education (TE) pre- and in-service students has been possible at this stage, it can be safely assumed that teachers and TE students represent a wide range of characteristics, including factors such as socio-economic, motivation, educational ability levels including literacy, teaching abilities, geography and gender.

The primary school enrolment rate is low (42% during the period 1986-92)[2], particularly for females, whose enrolment rate is only that of males

The adult literacy rate is low (47% of males in 1990, and 21% for females) while in the period 1986 to 92, 29% of eligible males were enrolled in secondary school with only 13% of females enrolled

About 70% of the population live in rural areas where poverty is pervasive. Access to education is limited in rural areas.

From this data on Pakistan's children, certain inferences about Pakistan's teachers seem valid:

- Clearly there are insufficient female rural teachers and schools available.
- With adult illiteracy rates being so high, it would be surprising if the standard of adults presenting for teacher training was of generally high standard.

Recommendations

Some major implications to be drawn from this data are as follows:

2.1.1 Quality educational software must be produced to help dramatically improve the standards of Pakistan education and TE in particular

2.1.2 On the observations and data available, including comparable overseas countries, the media/technologies that seem to be most appropriate for Pakistan are as follows

Audio cassettes (using batteries/mains power)
Audio/Print (eg printed modules/sheets, and teacher's guide)

Print — textbooks modules (booklets) posters, charts, maps etc,
Video cassettes — with teacher's guide and worksheets
Broadcast TV and radio — with teacher's guide and worksheets
The Computer — though this is a complex issue requiring careful consideration
Slides with teacher's guide and worksheet
Slide — tape with teacher's guide and worksheet
Overhead Projector
Opaque Projector
Role Plays and simulation games

2.1.3 Literacy levels must be raised in all pre and in-service teacher trainees, and training in literacy teaching should become a priority area in all TE programs.

2.1.4 Literacy materials and programs must be developed and acquired as a high priority.

2.1.5 Distance learning techniques and equipment capable of supporting distance learning in the rural areas, must be given priority, including basic print materials, as well as sound and video broadcasts and tapes .

2.2 New TE courses are being developed.

Recommendations

2.2.1 Further detailed planning on the new range of TE courses will mean a range of good quality hardware, software and instructional approaches and techniques is required.

2.3 Provincial pressures for allocation of electronic media equipment.

There have been the usual pressures evident for the speeding up of allocation of the US$3m worth of AV equipment. This is understandable, but the NA was a necessary pre-requisite to the allocation process, and if any of the pressures came from the donor's desire to have loan money spent, it is regrettable.

Recommendations

2.3.1 The sensitive issue of equipment allocation must be allowed to proceed without undue pressures, until the NA has been completed. The latter has now been completed as far as available data will permit, and allocation is proceeding, with ADB tenders to be called any time.

2.3.2 In order to facilitate the establishing of the PITE's, TO's MTU's and Model GCET's these institutions should be given priority in the equipment allocation process.

2.4 Teacher/principal attitudes towards the equipment and software.

It is important that the enthusiasm towards the acquisition of hardware is matched by comparable enthusiasm towards the acquiring of relevant and effective software.

Recommendations

The main strategies likely to assist on the key attitudinal issues are:

2.4.1 Imaginative and practical ET utilisation training in pre and in-service education programs, including teaching practise AV utilisation tasks.

2.4.2 The availability of high quality and relevant software must be given priority. It should be noted that early ET input in the curriculum planning process is a necessity.

2.4.3 The ET consultants should plan to visit each Province, particularly the PITE's about a month prior to the arrival of the equipment, and again about a month after its arrival if possible.

2.5 Potential sources of software

Recommendations

2.5.1 Ready-made good quality and relevant software must be sought from overseas sources and reviewed for use in Pakistan if appropriate.

2.5.2 Relevant software for all media must be produced for as many TEI courses as possible at the national level (Allama Jqhal Open University, Channel 2 etc) regional level PITE's and for some media, even locally.

2.5.3 Commercial materials produced in Pakistan should be considered under guidelines to be determined.

2.5.4 The Project Management — national and Provincial, must give priority to developing an infrastructure to enable instructional materials to be accessed and used from all over the nation, and for decision-making regarding nationally produced materials.

2.6 Availability of Ancillary Funding.

Funding for software, raw materials, maintenance etc, requires recognition and Government commitment.

Recommendations

2.6.1 The matter is as much an issue for utilisation education as Government commitment.

2.7 Specialist ET Assistance for Teachers

It is assumed that Pakistan currently has no qualified Educational Technology Specialists (ETS), the roles of which are set out in 2.7.1/2.7.2 below.

Recommendations

2.7.1 The ETS has the experience, training and creative skills to produce good quality software specifically designed for the needs of the client teacher/instructor.

2.7.2 The ETS is able to work with teachers in assessing their teaching needs, offering informed ET advice and assisting in procuring and/or producing materials, and in helping to implement strategies in the classroom if required.

2.7.3 Plans are under way for the training of ETS through a post-graduate level course at a recognised Pakistan university.

2.7.4 Links should be formed with the Lahore-based National Educational Equipment Centre (NEEC) because of mutually beneficial possibilities, e.g. NEEC has developed a low-cost robust good quality overhead projector for schools.

2. 8 Developing a Profession of Educational Technology Interested People.

ET is a complex and constantly changing and expanding area, and experience has shown in as many countries, the ETS's benefit significantly from being able to be members of a professional organisation designed to help them.

Recommendations

2.8.1 A professional Pakistan Society for Educational Technology should be established. There has already been a most positive response to the concept, and it is hoped that the Australian Society for Educational Technology (ASET) at its Biennial International Conference (EdTech'96) will offer appropriate assistance and encouragement to the Pakistan initiative.

2.8.2 Consideration should be given to creating a career path for ETS's.

2.9 Adequate Storage and Access for Hardware and Software.

The secure, clean, cool and dry storage of both hardware and software is a matter that requires priority planning. A related and equally important issue is the need to develop a system by which teachers can gain meaningful information about software, so that they have the potential to borrow software from a PITE in another province or a national library/resource centre.

Recommendations

2.9.1 These matters above must be addressed energetically by Project Management at all levels because it is a more complex matter to implement than one would expect.

2.9.2 Every effort must be made at all times and levels, to ensure compatibility of hardware and software right through the system.

2.10 The Roles of the Mobile Training Units (MTU's).

Recommendations

It is anticipated that there will be two rather than one MTU per Province because of the valuable service they can offer and because of the distances involved in most provinces. Their roles will be as follows

2.10.1 Crews consisting of an ETS and AV Technician will be able to assist staff in colleges and TO's with ET and other training programs, equipment maintenance, information on available software and ferrying preordered software and hardware as appropriate.

2.10.2 Additionally the units will be so configured as to enable them to function as Outside Production Units, thus extending the production flexibility of the PITE production centres.

2.11 Overseas Lessons Regarding the Application of ET Particularly in Developing Countries

Fortunately much has been learned in this field around the world over the last decades. Arguably the best source of collected wisdom on the matter is contained in seminar summaries from UNESCO.

Recommendations

2.11.1 The UNESCO reports (1988-95) will be studied so that relevant information can be included in the final draft of the Total Educational Technology Plan (TETP).

Conclusion

The ET portion of this paper is effectively a draft of the TETP, but it will vary from the final version only in terms of fine detail and volume, since there is still much information to be included in the final plan.

Footnotes

1 ADB Appraisal Report ADB Bangkok, 1996 p3

2. UNICEF State of the World's Children Report 1995 UNICEF, New York 1995 Table 1 (pp66-7)

3. Ibid Table 4 (pp 72-3)

4 ADB Appraisal Report ADB Bangkok, 1996, p5

Although beyond the terms of reference of this Project, it is interesting to note that in the mid 1960's, a highly successful Italian project called Telescoula, used broadcast TYV at the local village level to solve their high rural illiteracy problem. Today, Italy has one of the highest literacy rates in the world (UNICEF State of the World's Children Report, 1995 Table 4 (pp72-3)

Report on the Teaching and Learning on the Internet Project — RMIT TAFE

Laurie Armstrong
Open Training Services

This paper reports on the initial stages of developing training modules for study by students on the Internet in a course on Local Government. It has been written by a teacher with minimal background in computing and is intended to assist other teachers to develop skills in the area of training provision on the Internet whilst avoiding some of the difficulties encountered by the author. The paper canvasses some of the likely advantages of this type of training, in particular in comparison with traditional off campus study methods, as well as some of its limitations. Issues for teachers and learners in the provision of training courses on the Internet are discussed. The paper concludes with a description of the elements of a successful approach to the delivery of on-line training

Training modules developed for delivery on the Internet as part of RMIT's "Teaching and Learning on the Internet Project" are within an Associate Diploma of Local Government. The model developed for this course is progressively being adopted by other courses in the Public Administration and Community Justice fields. With successful trialing and modification this model is anticipated to be extended across a broad range of courses at RMIT.

Readers are invited to view materials associated with these modules at:-

http://wwwtafe.lib.rmit.edu.au/localgov/localgov.html'?

and make comment to the author at opentser@ozemail.com.au

Primary features of the model include:-

- Use and integration of the resources available on the Internet as teaching assets.
- Efforts at integration of the on-line learner with the RMIT campus and community.
- Sections on "Studying On-line" providing advice and sites for software to assist the on-line learner.
- On-line enrolment of students via eMail.
- Use of a range of communication software including eMail, PowWow and Hypernews to maximize the interaction capacities of the Internet for teaching.
- On line access to RMIT library and range of other resources.
- Full course and module information available on-line.
- Student and teacher conferencing.
- Bulletin board for posting of class news and assignments.
- Electronic submission of assignments, marking and feedback.
- Constant monitoring of learner reaction to internet training delivery approach.
- An evolving method of teaching which is sensitive to learner needs.

This work is very much in progress and is currently being trialed with a class of fifteen students, which is leading to continued change and improvement.

Potential for Training Delivery on the Internet for Students and Colleges

The most obvious possibility for training provision on the Internet is its potential for broadening the access to training by students. In the case of training for local government workers, because many of them are located outside of the metropolitan area, they often are geographically isolated from training institutions. Where they have access to the necessary infrastructure to study on the Internet, providing training in this way is of particular benefit to them.

Similarly, potential students who are home bound for any reason may be interested in this mode of study. For existing students who are attending part time the current structure of the course requires them to physically attend classes at the college outside of work hours. This is often an onerous demand on full time workers with family and other responsibilities and study through the Internet will be of a major advantage to them in progressing through their course.

An extension to those benefits discussed above as part of increasing access to training is that from the training institutions' perspective. It potentially vastly increases the possible "reach" of training. Not only are the problems of students who are physically distant from training institutions alleviated, training on the Internet allows those institutions who themselves are located away from major population centres to enrol students from any location. In this way the possibility is open for a college to become in a sense "geography free" and no longer bound to enrolment numbers which reflect the population which can physically access their campus.

The Internet will allow colleges to cooperate in a fashion which greatly benefits their students. In the example of local government training one course may be in local government law requiring a specialised body of knowledge held by teachers to offer the course competently. If say five colleges are offering local government law they currently all require a teacher with that level of expertise. However, if the course on local government law is available on the Internet then enrolled students in one college will be able to enrol with another college with the requisite expertise. The advantages of bringing that expertise to a larger student population rather than having other colleges replicating the course at a lower standard have obvious advantages for the training system overall.

Sharing of skills means that colleges will be able to significantly improve their "customer service" to students and the overall quality of the training provided. Similarly customer service is vastly improved in Internet training systems which allow students to enrol at a time that is convenient to them rather than at college specified semester or term dates. In other words students can start to work on training in a way that is free of time and place.

Finally from a college point of view the potential unit cost, or dollar cost per student, of Internet training will be significantly much lower than is currently the case. Where the college becomes much less tied to maintaining expensive physical infrastructure such as classrooms, which in any case remain idle for much of the year, large savings in expenditure will accrue to the college.

The Internet Compared to Traditional Distance Education

If Internet training is thought of as a variant of off campus distance education it has very significant advantages over its predecessors. One emphasis in the present project has been to maximize student involvement through the employment of the Internet's capacities for communication and information retrieval. Where distance education is based on print based materials it cannot match the Internet's ability for immediate contact with teachers and other students or it's ability to maximize student active involvement in their course of training.

Students communicate and collaborate with their teacher and dispersed colleagues and peers with an immediacy not previously available. They are able to operate as information managers and researchers in their studies and develop skills associated with each of these activities in electronic communication as well as learn the substantive content of the course they are undertaking.

Where files can be rewritten virtually overnight the currency of information provided on the Internet can be assured. For example in a module called "Introduction to Australian Government", about the operation and issues of government, a major political issue may develop. In that case students can be immediately directed to web sites containing information or discussion about that issue.

Finally, traditional off campus distance education material is written for a generalised student base making little concession to the range of potential students' needs. However, with the Internet it is a relatively simple matter to customise information so it best suits the learning needs of small groups of students. For example with the recent emphasis on work based education a college may have a number of students enrolled from one local government authority. If this were the case it is open to the teacher to provide materials to students by tailoring existing files with examples and exercises directly related to the learners own workplace.

Preliminary Issues in Setting up the Project

For the teacher embarking on a project to develop Internet training one of the first issues to confront is how the project is to be resourced. Our experience has been that there are very significant costs associated with a project of this kind and that necessary resourcing for a successful project needs to be substantial at the outset.

Costs will vary depending on the availability of resources within the college however they may include the cost of a computer server, modem connections, technical and computing assistance, costs associated with the development of courseware and the costs of the teachers own time in developing their skills. Much of the latter is time spent on "environmental scanning" on the Internet to see what others have done and generally spending time on-line to become acquainted with the possibilities of the Internet as a teaching tool. Thankfully the media has focused so much on the Internet recently that decision makers within colleges are familiar with it, at least in a generalised way, and if presented with some of the advantages to colleges canvassed above may be willing to finance projects of this sort.

Whilst the up front cost of development may be relatively high there is a point in projects where development is swift and returns begin to materialise. In this project we have focused in the local government area on the building of a model which could be adapted to not only all the courses in local government but also a range of other courses in other disciplines. Thus on completion of this model a large number of courses and subsequently a large number of students will be able to be enrolled.

Further to the issue of costs and funding it has been the experience of this project that it is difficult to apply for funding for Internet projects because of the uncertainties of what realistic dollar amounts for a project might be. Where funding applications are for types of projects that have been undertaken previously it is a relatively simple matter to provide realistic costings and for that matter timelines based on previous experience. With projects such as this, where new ground is being explored, costing is difficult and can only be roughly estimated and depends a wide range of variables such as equipment availability, time donations by teachers, costs of technical help etc. One of the outcomes of the present project is to develop realistic funding models for future projects. As a guide it might be said that whatever you may feel the cost of a project is, a more realistic figure is probably double that.

A consistent theme in this project has been that while there are a multitude of technical and computing issues to resolve the primary issues are educational. This stance is necessary to ensure that outcomes are driven by what teachers believe is educationally useful rather than driven by what computing experts want to provide. At its simplest level this approach means that teachers involved in the project suggest what they would like to be able to do with the Internet. Technical staff then take these directions as problems to solve by, for example, finding suitable software.

With educational concerns at the forefront teaching experts are likely to emphasise the use of the Internet in innovative ways to maximize interactivity with and between learners and teachers, active learning strategies and learner support. These kinds of approaches are more likely to ensure that the learner gets a educational service that promotes his or her interests.

A further early issue is the one of design. A cursory examination of Internet publishing shows that the standard of web page design is often very high. In order to maintain students interest and allow them easily to use training materials provided, emphasis from the outset should be given to aspects of design and layout. This includes graphics as well as ensuring a logical flow of information which is presented clearly, and in a way that allows the learner to easily navigate through materials. Further to this issue with the ever increasing use of the Internet, colleges will need to maintain an image of their organisation on the Internet which is consistent with the other external images presented to students and the general public.

The Role of Teachers

The introduction of Internet training will significantly alter the work of teachers. In the most obvious way teachers will be spending more of their work time at a computer sending and replying to eMail, writing teaching materials, running on-line tutorials and conducting research for their courses on the Internet.

Less obviously teachers will be involved in a different type of learning than that with which many are familiar. Where much of their work has been in the role of a transmitter of information and a guider of student learning activities this will substantially change in the learning environment enabled by the Internet. Where encouragement is given to students to access the vast range of information available on the Internet and to actively communicate with others around the world on a particular topic, the teacher will become much less the single authority on subject material and in many cases a co-learner with their students. The teachers major responsibilities will be to facilitate students to achieve the particular competencies or learning outcomes associated with a course as well as have responsibility for the monitoring of quality.

In discussing a new role for teachers we are really talking about a new set of demands on teachers for professional development. Providing training on the Internet will require teachers to be subject expert, a "net" expert, a teaching expert and an industry expert. In essence this means certainly different work for teachers and probably, in the short term, more work. The response of the colleges to this must be one of negotiation and adequate provision of professional development activities. Teachers themselves will need to recognise their own needs for skill development.

Another issue uncovered for teachers in this stage of the project has been the absolute necessity for access to technical support from staff who are both technically competent and able to communicate well with teachers who may be at very basic levels of understanding. Confusing or intimidatory advice from technical staff is one of the major stumbling blocks for teachers coming to terms with firstly the technology and then the range of issues associated with the professional and educational implications of training on the Internet.

On-Line Learners

The first issue for learners in this project has been the mastery of the computing skills required to study on the Internet. Students with whom the model has been trialed thus far have previously completed introductory computing modules and so have had keyboard and mouse skills as well as the self confidence to approach this type of study. From this base progress in learning to use the Internet has been surprisingly quick. It would be expected that younger students, because of more familiarity with technology of all forms, will be better able to engage with this new form of training delivery. However, it is apparent that rather than the fairly ad hoc approach to teaching students about the Internet used in this project there is a need for a systematic, competency based training module on the subject of "Learning to Learn on the Internet".

Initial observations of learners in this project are suggesting a range of approaches to the course. Some learners are undertaking work to meet the minimum requirements of the course whilst others are heavily involved in seeking out additional information, new ways to use the technology to their advantage etc. This points to a dimension of individual differences in learners which will be the subject of research as this delivery mechanism becomes increasingly widespread.

Learners have different learning styles and preferences as well as different knowledge and computing skills starting points. Internet learning allows students to progress through a course of study at their own rate but in setting up courses on-line it is necessary to think about providing the broadest range of study modes as possible to learners. It is also important to remember that education in its traditional form has also contained elements of social learning particularly for young people. Much of the maturing as individuals and intellectual development takes place in a social setting. It would be of great concern to many educationalists if young students were ultimately limited in their opportunity to interact with others in a physical environment.

Access and equity will be large concerns for learners. Where many students do not have Internet access it will require efforts on the part of educational institutions to alleviate this inequality. This may include unlimited access to computer laboratories on campus and in other community locations and the lending of Internet capable laptops to students for example.

Finally there are a range of pedagogical issues which need to be understood and addressed. These will become more apparent with the further use of this technology but initial observations suggest that they will include things like what do learners absorb when "web surfing" and how is this different from examining printed materials? Also how will learners interact with others on the net and what social norms and protocols will develop? Discussion with students for example has led to a contract with each individual on the proscription of materials that might be offensive during classes.

Getting Started on On-Line Training Delivery

For the teacher commencing on a project in this area it has been essential to develop partnerships and a team approach to the work required. This team has been composed of teachers, technical staff with the skills and sensitivities mentioned previously, staff with expertise in flexible delivery and insights into how students learn in this mode and, importantly, decision makers who command a budget which can finance the project.

Such a team recognises that no one individual will command all of the skills required to undertake such a project and provides for group learning by all the staff involved. Gradually through mutual respect and patience all members of the team will be able to contribute and raise the skill level of other participants. To achieve this sort of atmosphere has required many informal meetings, discussion of mutual problems and an openness and sharing of knowledge and problem solutions.

Whilst a team approach is emphasised here, this project has been predicated on the idea that whilst there are significant computing and technical problems to overcome the substantive issues are educational ones. That is to say that the project has been driven by teachers and concerns around student learning and not by the technology itself. The flow of ideas for development of the model has been in general teachers specifying what elements they believe will be important to facilitate student learning and technical staff supplying software and programming solutions to allow those elements to be catered for. For example, where it has been considered important for students to be able to undertake a course in as simple and as intuitive a way as possible this has required some technical innovations to make this possible.

Whilst it is recognised that different subject material will require different approaches to allow it to be offered on the Internet when embarking on a project of this kind it is important to attempt to build a generalised model for training delivery. As has been mentioned this has allowed rapid expansion of gains made to new courses once a satisfactory model has bee constructed and trialed.

Curriculum used initially for this project consisted of materials already developed in print'based flexible delivery format. This material is available for students on-line and can be simply downloaded by them into their computer's word processing software. As the project has progressed it has become obvious that this is not substantially different from providing the same materials to learners in print and does not take full advantage of the educational possibilities of the Internet. Class preparation for the teacher is now more similar to traditional preparation. It has consisted of preparing materials for learner review (web pages), interaction and questions.

Evaluation for this project so far consists of a feedback form that students are required to complete whenever they submit an assignment. This evaluation tries to gauge the students response to on-line learning and is expected to generate the starting point to explore many of the issues raised earlier in this paper.

Conclusions

It is apparent to anyone with a cursory understanding of contemporary technological developments that the Internet represents a revolution in communication. Where teaching is predominantly an exercise in communication the Internet represents a revolution in teaching.

With the increasing sophistication of our students in computing there will be demand for on-line delivery of training. Coupled with this students will be able to choose the institution with which they undertake a course of study. In this environment colleges and teachers will have little choice but to provide these services. However colleges will presumably not be providing all courses on-line because of developmental and maintenance costs. As a result colleges will need to make some strategic decisions about where their educational strengths lie. That is what courses they feel they can compete nationally and eventually internationally and, as a consequence where their emphasis for on-line delivery will be.

Finally whilst we must come to terms with the vast potential of the Internet this view must be tempered by a recognition that the Internet is a supplement to other methods of training delivery. That is to say it is one addition to a range of delivery vehicles. It is apparent that this type of training is neither educationally suitable for all subject material or all students. What are the best uses of the Internet are largely sill unknown.

A summary of elements of a successful approach to development of delivery of on-line training are:-

- Fostering of institution support particularly for resourcing of projects and release of teachers.
- Establishment of project team with requisite range of skills.
- Ensuring that the driving force for the project comes from teachers not technologists.
- Strategic organisational approach to what courses to target for development.
- Emphasising good design to engage and maintain student interest.
- Maximising the communication and information retrieval possibilities of the Internet rather than information dissemination.
- Focus on the building of a model of training delivery that can be adapted to a range of courses.
- Immediate, sympathetic and good quality communication on technical issues to assist learners and teachers.
- Professional development and time release for teachers.
- Continual improvement, responsiveness and innovation in teaching approaches to best fit students and subject material.

A Dissemination Strategy for Student Adoption of Internet Services

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Adoption of new educational technologies usually requires a dissemination strategy as an explicit element in the design of a system. This paper reviews a number of elements in a dissemination strategy for Internet services, based upon our experiences with "cleo" and "carmen", Internet hosts operated by Murdoch University Academic Services Unit. We sought to offer the greatest scope for student involvement and a collaborative learning approach to Internet services, whilst also addressing concerns over the cost and organisation of access facilities, regulation of user behaviour, equitable access for all students in a class, and the need for user training and technical support. We sought a "student driven" adoption of Internet use, a dissemination by popular demand, as a prerequisite and stimulus for future applications in formal teaching and learning.

At times educational technologists encounter critical comment about "technology driven" innovations in teaching and learning. Bowser and Shepherd (1991) expressed this risk in the form of a question, "Are distance education practitioners finding a technology and then inventing an application?". This kind of question weighed heavily upon our planning during late 1992 when our External Studies Unit obtained funding for a project described at the time as the "External student email project". We began by looking for a "student driven" way to introduce computer mediated communications into Murdoch University's distance education delivery.

This paper describes some of our experiences with the idea of a "student driven" adoption of Internet services. When our first host, "cleo" (cleo.murdoch.edu.au) went live in March 1993, it was not at all clear that concepts such as "student driven" and "Internet services" were meaningful, let alone viable. Although staff use of Internet email for research and administrative communications grew rapidly at Murdoch University during 1993-95, the idea of using of email and other kinds of Internet services for teaching and learning purposes attracted little attention. Very few students had access to email and other Internet services. Any attempt to incorporate these into teaching would require unit coordinators to devote an excessive amount of time, effort and very scarce funds towards organising an effective way to overcome that barrier.

In this context, we conceived cleo's primary purpose to be the establishment of "computer mediated communications" as an attractive medium being used voluntarily by an increasing number of students. We knew that we had to overcome the access barrier without recourse to any special effort or major funding by the University. We knew that we had to cope with growth in student demand and with organisational change. In February 1996 cleo was joined by our second host, "carmen" (carmen.murdoch.edu.au), and we are part of the Academic Services Unit which succeeded External Studies in May 1995.

Cleo's principle objective did not change during 1993-96, except that it is now shared with carmen. The principle objective is "to attract sustained attention to and use of computer mediated communications for education and information purposes by developing a viable base of modem users and a range of attractive services" (Atkinson and Rehn, 1995).

Modem communications

Cleo's operations tackled the creation of a "viable base of modem users" because Murdoch University lacks on campus facilities for student access to email and other Internet services. This feature of our context is unlikely to change significantly until late 1996 or 1997, although on campus access to Internet services via cleo and carmen has been trailed for some students, notably with several Law School classes in a CAUT Project and a group of international students (Atkinson, 1995i). When on campus workstations are not available, developing a user base amongst undergraduate and graduate coursework students depends very much upon modem communications, for which students purchase and house at home their own personal computer and modem, and provide their own telephone line.

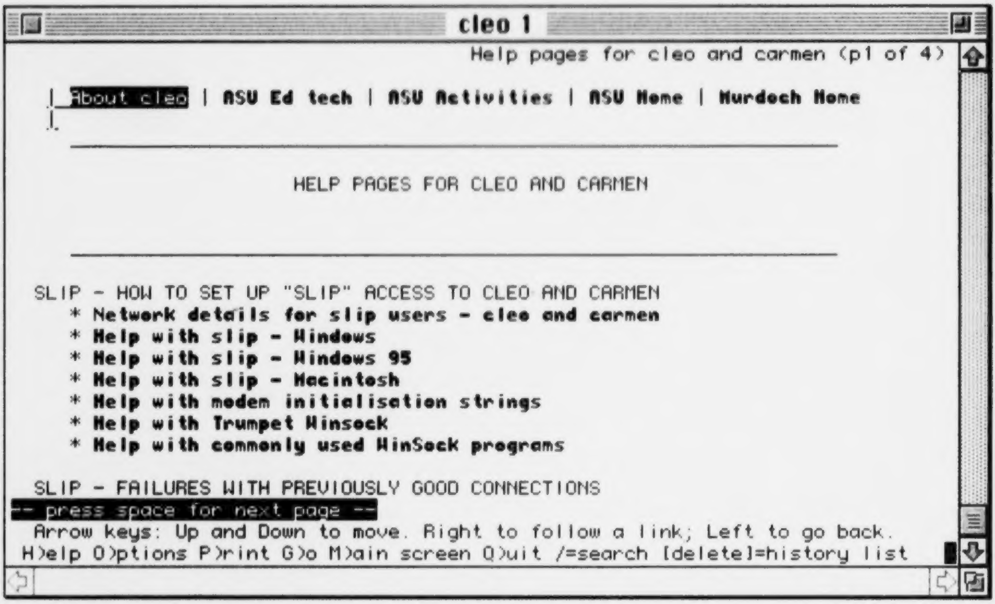
Unfortunately, modem communications are not undertaken easily. Apart from the expense of a modem, usually in the range $140 to $500, it is often quite a demanding matter to install and learn how to use it effectively and efficiently. The University has to provide the modems and telephone lines which answer a user's modem call, a host computer and the local area networking infrastructure, though these are now relatively economical aspects. User training and support services, host management, fund raising and other tasks have to be undertaken.

However, there are certain advantages for modem communications. Typically, a student's home is also his or her personal work space, favoured by a sense of ownership and control which is usually not attained with communal facilities in classrooms, laboratories and libraries on the campus. Connecting users via a modem pool does not entail the rather large expenses and maintenance work associated with providing laboratories filled with personal computers for on campus use by students. Also, in Murdoch University's context, modem communications offered an avenue for rapid growth. This we attained by giving cleo and carmen accounts to on campus students and we did not restrict ourselves to external student services only. On campus students are eligible if they have their own home based personal computer and modem.

How we developed attractive services

The overall strategy for obtaining "sustained attention" and "a viable base of modem users" is to develop attractive services. We sought the broadest possible basis for this strategy, including the features summarised in this list:

- Offering users full access to the Internet. The wider the range of services and purposes offered, the greater is the probability in favour of successful commencement and continuing, effective use (Atkinson, 1995a). However, this approach may be criticised by those who feel that it allows excessive use for social and recreational purposes in contrast to academic purposes.
- Attractive local services from cleo and carmen's web servers, majordomo listservers, ftp servers, pop servers (for Eudora and other email agents), slip emulation, irc clients and other services, plus access to the University's Internet newsgroups host "newsman" (Atkinson, 1995b).
- Facilitating access from computers at home via modems, by enabling the use of graphical interface software for Internet services (Atkinson, 1995c). Supportive induction for new users, including individualised assistance for initial technical problems (Atkinson, 1995d).
- Avoiding extrinsic pressures to learn at a specified rate. Users do not have to learn how to use the technology in time to meet assignment submission deadlines and examination schedules for study in specific units. However, this approach may be criticised by those who feel that it places excessive reliance upon extra-curricular learning, in contrast to the usual procedures for structuring university study into formally assessed units.
- Avenues for group communications on technical matters in using computers, for the dual purposes of providing user support for novices, and giving experienced users a forum for helping and teaching other users and for contributing towards enhancement of the system. Our main avenue is the emailing list "eff_one@cleo" run by cleo's majordomo listserver (Atkinson, 1995e). Eff_one provides a very substantial supplement to the user support services available for cleo users.



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                                    Help pages for cleo and carmen (p1 of 4)

   |_About cleo | ASU Ed tech | ASU Activities | ASU Home | Murdoch Home
   |.
      ____________________________________________________________

                         HELP PAGES FOR CLEO AND CARMEN

      ____________________________________________________________

 SLIP - HOW TO SET UP "SLIP" ACCESS TO CLEO AND CARMEN
      * Network details for slip users - cleo and carmen
      * Help with slip - Windows
      * Help with slip - Windows 95
      * Help with slip - Macintosh
      * Help with modem initialisation strings
      * Help with Trumpet Winsock
      * Help with commonly used WinSock programs

 SLIP - FAILURES WITH PREVIOUSLY GOOD CONNECTIONS
-- press space for next page --
 Arrow keys: Up and Down to move. Right to follow a link; Left to go back.
H)elp O)ptions P)rint G)o M)ain screen Q)uit /=search [delete]=history list
```

Figure 1. Many users commence with serial communications, which enables them to read online documentation (accessed via the command "help" at the host prompt). This help page presented via lynx, a web reader for Unix, is to help users upgrade to slip communications.

- Avenues for purposeful communications relating to immediate, study oriented activities, such as access to the University CWIS, the Library's catalogue system, email to tutors, and experimental investigation of assignment submission by email.
- Avenues for group communications relating to the University's intellectual and social environment. For this purpose cleo runs the list "bushcourt@cleo" for student comments and debate on contemporary issues concerning the University community (Atkinson, 1995e). The list "telegraph@cleo" is run for geographically remote students.
- A substantial and growing user base, in terms of numbers of users and their level of activity. Accounts on cleo or carmen are available for both external and internal students, from any of Murdoch's Schools. The "liveliness" created by the users of a host attracts increased participation, for example users own web pages (Atkinson, 1995f) and community access (Atkinson, 1995g) are encouraged on cleo.
- Users in control of their own purposes and assured of a participatory role in shaping the purposes and management of their host. Issues include reasonable implementations of user charges satisfying both University and users, access to a full range of Internet services, privacy rights, freedom of expression rights, and the ethical conduct of communications and publishing activities (Atkinson, 1995h).
- Securing additional funding to cater for growth and operational expenses. Cleo's main external grant was from the Committee for Advancement of University Teaching (CAUT) for the 1994 project "Collaborative learning through computer conferencing" (Atkinson, 1995i). User charges now contribute a substantial part of cleo and carmen's funding (Atkinson, 1995j). From late 1996 additional funds became available through Academic Services Unit salary savings and the University's NPRF 96 Project (Atkinson, 1995k).

Outcomes from cleo operations

The number of student users of cleo grew rapidly during 1994 and 1995, until cleo growth was placed "on hold" by the University's Information Technology Policy Committee (ITPC) in mid 1995:

Feb94	Jun94	Mar95	Sep95	Dec95	Mar96
45	308	459	607	541	837 (including carmen)

The pause in cleo growth in mid to late 1995 was due to concern over cleo users taking a dominating share of the capacity of the University's modem pool. Critics were not impressed by the argument that cleo had averted concerns about the modem pool being a "white elephant". There was uncertainty about the impact of traffic volume charges which were introduced for AARNet members in 1995, and a view that development of University policies on Internet access for students should not be pre-empted by the rapid growth in cleo's operations as the only provider.

However, after a period of declining numbers and an extensive deletion of inactive users and users who had left the University, the main uncertainties have been overcome by a series of actions and events which opened the scope for a resumption of growth. These include:

- Introduction of user charge for cleo and carmen users (Atkinson, 1995j). Current levels are $25 per six months for student users, and $45 per six months for community users (our community users, mainly school teachers and librarians, are differentiated from student users). Income is used for modem pool expenses, traffic volume charges and minor maintenance. It is not a full cost recovery charge, because staffing for cleo and carmen operations and hardware depreciation are not covered.
- Creation of a "cleo only" modem pool, which countered the criticism that cleo users were "hogging all the modems" and preventing staff users from obtaining connections. Capacity for the cleo and carmen only pool is leased from Computer and Network Services Unit under a full cost recovery charge, currently $590 per port per year.
- A strong defence of cleo's role and strategies by cleo's users. Ironically, the threat that cleo would be forced into a negative growth phase turned out to be a stimulus for increased student utilisation of Internet services. For example, the new list "bushcourt@cleo", set up initially to discuss user charges and "how to run cleo", attained viability very quickly and at this point in time is the major avenue for electronic debates and consensus formation on topical issues concerning the Murdoch University community. There is no comparable service for staff.
- At the end of 1995 ASU funds from salary savings became available for a hardware upgrade costing $14,000 (Atkinson, 1995j). After porting cleo to the new hardware and stabilising operations under Solaris 2.5, the most recent version of Sun's Unix, the old hardware was brought up again within a few weeks as carmen, also under Solaris 2.5. Running as a "team", cleo and carmen can support up to 2,000 users, whilst still reserving adequate capacity for a heavy load in web serving and listserving.
- The resumption of growth during the summer of 1995-96 was backed also by funds becoming available from the Internet access module and other modules in the University's NPRF 96 Project, "Innovative delivery methods for Murdoch University's South West Campuses" (Atkinson, 1995k). Other vital factors are a healthy position in the user charges budget, continuing enhancements in user support documentation and techniques, a downward trend in the prices of modems, a resurgence in the level of inquiries for first time Internet access via carmen, improved procedures for induction of new users, improved system reliability including an uninterruptible power supply, support from student organisations, successful addition of Windows 95 users, and confidence in a "user driven" approach to future introductions of teaching and learning applications based upon world wide web and email list services.

In 1994-95 an estimated 6 — 8% of Murdoch's undergraduate and graduate coursework students (500 to 600) obtained some experience of Internet access via cleo using modem connections, and a further 1 — 2% (about 100 students) obtained experience via private providers or employers. About 130 law students obtained Internet communications experience via the Law School computer laboratory and cleo. About 30 of these used modem access to cleo from home in addition to on campus access.

By March 1996 cleo and carmen passed 10% "market penetration" in Murdoch's student population. As the University's Computing and Network Services Unit and several Schools put up hosts later in 1996, linked with workstations for on campus access by students, we can look forward to a University aggregate figure near 25% by the end of 1996. This will do much to overcome the local perception that Murdoch has fallen behind other Western Australian universities in Internet access as an area of student services.

The ultimate extent to which Murdoch students will provide their own home based equipment for Internet access via cleo and carmen or other hosts is uncertain, but 40% by the end of 1997 could be a realistic forward estimate. The extent to which this growth will be spread equitably over the University's entire student population is also uncertain. The principal area of difficulty is off campus, geographically remote students who do not have low cost Internet connections available. Students in cities other than Perth are not a problem, for the ADEnet Project meets their needs for low cost access (Atkinson, 1995l). Some remote students have tried Open Net at $9 per hour, but local providers or STD calls to cleo and carmen are the dominant solutions favoured on the basis of lower costs. Another area of concern, also impacting mainly upon off campus students, is that students who experience difficulty in access to user training programs for information technology skills will be disadvantaged, just as those who do not acquire language, literacy, numeracy and library skills are disadvantaged in tertiary study. However, concerns about under representation of women users have receded, for we now approach 40% women in cleo and carmen's user base.

Regulation of user behaviour is not a major issue amongst cleo and carmen users, although some staff appear to be fearful of the risk that student actions on the Internet may lead to criticism of the University. Cleo has an extensive record of freedom from significant incidents in the contentious areas of content regulation, hacking and copyright. Cleo and carmen user interest in "objectionable materials" is at a level similar to that found on Internet hosts generally. In line with the Internet community at large, bushcourt@cleo debaters are very much opposed to the simple blanket forms of censorship sought by some sections of society.

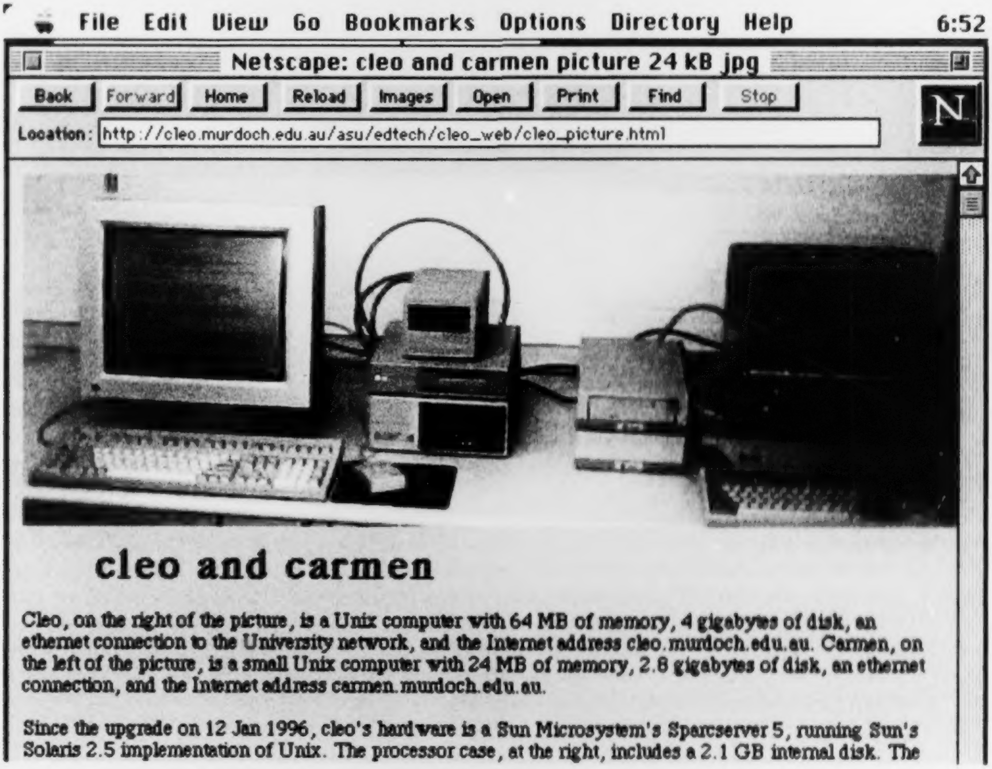
Cleo and carmen's strategy of promoting student adoption of Internet services by "attracting sustained attention" and a "viable base of modem users" attained maturity, and a sustainable momentum, by the summer of 1995-96. It is now time to increase the effort towards the next phase of growth, which is in the carriage of teaching and learning applications. The final section of this paper examines some implications and give suggestions on how to broaden out from the user base secured during 1993-96.

Some implications for teaching and learning applications

In developing teaching and learning uses of computer mediated communications, we need to aim for the same kind of "natural" ease of use and familiarity which we associate with using lectures, tutorials, books, the University Library, and face to face communications with students. Whilst cleo and carmen's user base demonstrates some modest progress towards that goal, in spite of difficult circumstances in technical and resource aspects, the next major step in bringing computer communications into the "mainstream" will depend to a large extent upon the University's introduction of on campus facilities.

Student adoption of on campus access to Internet services is likely to be enhanced by offering a wide choice of environments. These may include traditional "computer laboratories", Netscape workstations in the Library environment, workstations in a "coffee shop" or "cybercafe" environment, and workstations in Student Village (the University's student housing). Experience with international students at Murdoch through the Council for International Educational Exchange, Institute for Study Abroad and other schemes who became users of cleo for their one or two semester visits gives some indications. Small, informal rooms each with a relatively small, socially coherent group of users are likely to be favoured by students. Two main variations are envisaged, "quiet" environments in the Library or within School Buildings, and "social" environments in School Buildings or other locations such as the Guild of Students in the University's Amenities Building.

If modem access is complemented by on campus access from a variety of environments and with full access to Internet services, we will meet one essential prerequisite for teaching and learning applications. This is a very extensive student user base, familiar and at ease with computer communicated "reading" and "discussion", and ready to enrol in units which feature obligatory use of Internet services. The second essential prerequisite is a body of staff who are also familiar and at ease with teaching via Internet services. In this aspect the development strategy promulgated by the Academic Services Unit is to build up a relatively simple infrastructure for delivery, comprising world wide web server and listserver.



Location: http://cleo.murdoch.edu.au/asu/edtech/cleo_web/cleo_picture.html

cleo and carmen

Cleo, on the right of the picture, is a Unix computer with 64 MB of memory, 4 gigabytes of disk, an ethernet connection to the University network, and the Internet address cleo.murdoch.edu.au. Carmen, on the left of the picture, is a small Unix computer with 24 MB of memory, 2.8 gigabytes of disk, an ethernet connection, and the Internet address carmen.murdoch.edu.au.

Since the upgrade on 12 Jan 1996, cleo's hardware is a Sun Microsystem's Sparcserver 5, running Sun's Solaris 2.5 implementation of Unix. The processor case, at the right, includes a 2.1 GB internal disk. The

Figure 2. Netscape web reader view of cleo and carmen's statement on hardware (only the first two lines of text are visible). This picture occupies only 24 kB of disk space on cleo, only about one eighth of the file size required for word processor handling of the image. It was taken with an Apple QuickTake digital camera and normally would never be viewed via a paper print.

World wide web and listserver delivery of teaching and learning activities have a number of advantages compared with more complex forms of computer assisted learning. A web server provides a form of "lecture presentation", which is complemented by an email listserver providing a form of "tutorial group discussion". Our initial experiments in "tandem" operation of web pages and emailing list are very encouraging. These are in progress in several directions, including the list edtech-aus@cleo and web pages http://cleo.murdoch.edu.au/aset for Australian Society for Educational Technology, the list trdev-aus@cleo and web pages http://cleo.murdoch.edu.au/trdev-aus for the TAFE, vocational education and training sector, and some electronic journal developments. Initial experiments with Murdoch University units supported by web pages and emailing list will develop during 1996-97, in particular those associated with the University's NPRF 96 Project for innovative delivery to branch campuses.

Designing units for delivery support via world wide web pages and an emailing list is simplified through enabling relative ease of use by unit coordinators and tutors, compared with the greater complexities associated with authoring tools for interactive multimedia resources. For email, the typical tools are one's word processor and an email handler such as the widely used public domain program "Eudora". Web page writing is more complex than email, but support services and training courses are available locally (Rehn, 1995). Colour photographs are readily incorporated into web pages (Figure 2).

By using standard Internet services such as world wide web and email, infrastructure developers avoid the very large investments of resources required to produce alternatives. Furthermore, it would be rather pointless to embark upon some kinds of developments, for example an email system specifically for teaching purposes, when great tools are readily available from the public domain (all of cleo and carmen's listserver software and associated Unix utilities are free from the Internet).

It isn't usually possible to test a range of hypotheses when introducing a new educational technology such as Internet communications. In general, owing to the shortage of resources, the best that we can do is can do is proceed with one hypothesis. In our context, we believe that we guessed well with our approach, "student driven" and "dissemination by popular demand". The main alternative to this is pilots focussed upon specific groups, such as one or two distance education units (for example, Boyd et al, 1996). Fortunately, CAUT support enabled us to conduct a major pilot which achieved a very gratifying complementarity (Atkinson, (1995i). This is the Law School's unit Legal Practice and Documentation, coordinated by CAUT Project partner Archie Zariski. Knowing the difficulties associated with attempts to attain 100% uptake by off campus students, we ran with this on campus pilot instead.

Strategies for introducing Internet services into teaching and learning are likely to vary widely between different universities, depending upon context factors such as allocation of funds, extent of dual mode teaching, nature of the student population, staff experience with new technologies and many others. The details of our experience with cleo and carmen may have only marginal relevance in other universities, but we hope that the principles expressed by the phrases "student driven" and "dissemination by popular demand" will be considered widely.

References

Note on references: In the world wide web version of this paper:
http://cleo.murdoch.edu.au/asu/edtech/pubs/atkinson_edtech96.html
the URLs given below are replaced by in text html links.

Atkinson, Roger and Rehn, Geoff (1995). About cleo. URL: http://cleo.murdoch.edu.au/cleo.html
Atkinson, Roger (1995a). Offering users full access to the Internet. URL: http://cleo.murdoch.edu.au/asu/edtech/cleo-web/cleo-internet-access.html
Atkinson, Roger (1995b). Cleo services — listserver, www and others. URL: http://cleo.murdoch.edu.au/asu/edtech/cleo_web/cleo-services.html
Atkinson, Roger (1995c). Graphical interface software for modem access to Internet services. URL: http://cleo.murdoch.edu.au/asu/edtech/cleo_web/graphical-interface.html
Atkinson, Roger (1995d). Supportive induction for new users. URL: http://cleo.murdoch.edu.au/asu/edtech/cleo_web/cleo-induction.html
Atkinson, Roger (1995e). Emailing lists eff_one and bushcourt. URL: http://cleo.murdoch.edu.au/asu/edtech/caut94/why-lists.html
Atkinson, Roger (1995f). Users own web pages. URL: http://cleo.murdoch.edu.au/asu/edtech/cleo_web/users-web-pages.html
Atkinson, Roger (1995g). Community access via cleo. URL: http://cleo.murdoch.edu.au/asu/edtech/
Atkinson, Roger (1995h). Cleo conditions of use. URL: http://cleo.murdoch.edu.au/asu/edtech/
Atkinson, Roger (1995i). Collaborative learning through computer conferencing. CAUT Project 1994. URL: http://cleo.murdoch.edu.au/asu/edtech/caut94/collab-learn.html

Atkinson, Roger (1995j). Cleo user charges. URL: http://cleo.murdoch.edu.au/asu/edtech/cleo_web/cleo_news.html

Atkinson, Roger (1995k). Innovative delivery methods for Murdoch University's South West Campuses. National Priority Reserve Fund 1996 Grant. URL: http://cleo.murdoch.edu.au/asu/projects/nprf96/nprf96.html

Atkinson, Roger (1995l). ADEnet Project. URL: http://cleo.murdoch.edu.au/asu/edtech/net_access/adenet.html

Bowser, Donald and Shepherd, Doug (1991). Student perceptions of the role of technology in enhancing the quality of management education at a distance. In R. Atkinson, C. McBeath and D. Meacham (Eds), Quality in distance education: ASPESA Forum 91, p80-89. Bathurst, NSW: ASPESA.

Boyd, A., Chisholm, G., Dougiamas, M., Fox, R., Herrmann, A., Kevill, R. and Thornton, D. (1996). Developing a CMCS for technophobes. In McBeath, C. and Atkinson, R. (Eds.), The learning superhighway: New world? New worries?, p65-72. Proceedings of the Third International Interactive Multimedia Symposium. Perth, WA: Promaco Conventions.

Rehn, Geoff (1995). Geoff's lessons on writing web pages (ASDF 95 Project). URL: http://cleo.murdoch.edu.au/asu/edtech/asdf95/lessons/lesson_index.html

Zariski, Archie. (1996). Student peer assessment in tertiary education: Promise, perils and practice. In Abbott, J. and Willcoxson, L. (eds), Teaching and learning within and across disciplines, p189-200. Proceedings of the 5th Annual Teaching and Learning Forum, Murdoch University, 7-9 February. Perth: Murdoch University Academic Services Unit.

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PC Based Video on Demand Trials

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This paper describes video on demand trials conducted within the Department of Visual Arts at Monash University. A prototype video on demand system was used to gain some understanding of the issues involved in the use of this technology in teaching. Qualitative trials were conducted with teaching and library staff as well as students. Although this technology has great potential, there are a number of issues that need to be resolved before it could be used widely in education. These issues are discussed and trials planned for this year are outlined.

1. Introduction

Until recently, video on demand systems were only available as massive, expensive, Pay TV video servers, able to store hundreds of hours of digitally encoded video and support thousands of users. In the last two years however, smaller, low cost video on demand systems able to screen video have become available. These systems store video in digital form in the same way as other digital material, such as text, still images and sound. They deliver video over existing data networks to suitably equipped PC's. They are designed to use existing infrastructure as much as possible.

Since PC based video server technology has only recently become available, it is not widely deployed. There is however tremendous scope for its use in education. Digital video has many advantages over VCR and other analog systems. Only one copy of a sequence is stored, yet multiple users are able to scan different parts of it. The material does not wear out with use and does not lose quality with age, nor does the signal deteriorate as the distance between the source and the client increases. Many education institutions have a substantial personal computer network that can be adapted to provide digital video on demand, as well as PC's that can be used as video on demand clients. The technology is reasonably affordable, flexible and is likely to be adopted widely in the next few years.

To gain some insight into the issues involved in using this technology in an educational environment that relies heavily on video, a simple, low cost, video on demand system was installed in the Visual Arts Library at Monash University, Clayton. Qualitative trials involving staff and students from the film and television studies section of the Visual Arts Department were then carried out. The aims of these trials were:

To gauge the acceptability, advantages and disadvantages of the Video on Demand system and Video on Demand in general.

To make qualitative comparisons with current ways of delivering video, and most importantly,

To identify the barriers to the successful deployment of this technology in a teaching and research environment.

The study of film and television within the Department of Visual Arts is undertaken from first-to-third-year at undergraduate level and also at Graduate Diploma, Masters and PhD levels. Courses are predominantly critical, historical and theoretical. Methodologies derived from semiotics, psychoanalysis, structuralism, poststructuralism, feminism and cultural studies may be used to analyse a range of issues such as the evolution of film form, film as a vehicle of ideology, and the construction of sexual difference through film. These courses consistently attract high student numbers. Analog videotape is used heavily as a teaching resource — for full length screenings as well as lectures and seminars. Students also use videos as a resource for assignments and independent study.

2. System Description

The system was installed in the Visual Arts Library under the supervision of the Librarian. Starlight Video Server software able to support up to 10 Microsoft Windows based PC clients was used. The video server provides true video on demand. Multiple clients are able to view, pause and reposition the same video sequence concurrently. The server software runs on a 486 EISA bus PC, equipped with multiple SCSI disks. Whilst the prototype system was only able to store two hours of digitally encoded material, a fully equipped system can store much more.

The video material was encoded from VCR copies at 1.25Mbit/s using the MPEG encoding standard and equipment developed at Monash University. MPEG encoding provides very high quality full screen video and audio at comparatively low bit rates, but is quite complex. This complexity makes encoding expensive when compared with other techniques and requires the use of additional hardware to be installed in the PC to decode the video stream. These MPEG decoder cards typically cost about $400.

The client software uses a standard Microsoft Windows interface to access the server of digitally encoded video material. Delivery of the material is over a standard Ethernet network.

3. Trials

3.1 Participants and Procedures

The video on demand system was demonstrated to all groups currently involved with the handling and use of analog video for film studies:

- academic staff ranging from senior lecturer to assistant lecturer;
- librarians and library staff from Visual Arts Library and the Main Library; and
- graduate and undergraduate students.

Each user was asked to critically evaluate the video excerpts using a range of criteria(such as quality, window size, user interface, psychological factors) and-to make comments. The trial periods, which lasted up to one hour, consisted of participants viewing the encoded materials and experimenting with the technology themselves. A number of useful observations arose from the discussions which followed the demonstrations.

Materials used in trials

Material for encoding was selected from the Department's teaching program. Approximately 90 minutes of material -excerpts from three television programs and two films — was encoded. A mixture of film and animation was used. All encoding was done through Siemens' Eikona system, developed at Monash University.

4. Observations by Participants

4.1 Potential Use in Research and Teaching of Film Studies

The components of film studies teaching are the full length screening, the lecture and seminar which may include video excerpts, and student re-viewing of the films for seminar preparation, assignments and visual tests.

The video on demand system was identified as being of most benefit to students in individual study of course material. Digital video offers distinct advantages in terms of access and use.

Currently there are limited facilities provided by the University main library for student viewing of videos. (No facilities are available for students within the Department of Visual Arts or the Visual Arts Library). In addition, the University main library generally holds only one copy of each video title, hence there is considerable reliance on students being able to obtain material from commercial libraries and watch it on players at home. To a certain extent, this restricts the material that can be used in courses and adds a financial burden to students who cannot access the material on campus due to high demand.

Video on demand has the potential to solve some of these problems of access. One digitally encoded video can be used concurrently by many users. Assuming sufficient PC clients were available, the demand for access could be met more effectively. The amount of time library staff spend processing video loans and monitoring their use would be reduced and the problem of theft or damage eliminated as the material is stored centrally on the server.

The flexibility of digital video enables new ways of presenting comparative materials as well as providing more efficient ways to undertake typical student assignments such as the preparation of a shot table. To carry out a detailed analysis, a student may need to view the same excerpt up to 20 times. Video on demand would allow multiple users to work on the same scene over and over again. With videotape this type of use results very quickly in visible physical damage and the need for costly replacement. There is no equivalent deterioration with digital video. The video on demand system also allows users to run a word-processing software concurrently on screen with the video offering a unique way of taking notes about a film.

The usefulness of video on demand for lecturing purposes is less clear and requires further investigation. Film research requires access to such a broad range if visual materials which effectively puts it beyond the scope of institutional video on demand system.

4.2 Encoding Issues

The issues identified as the most problematic in the use of the technology in the teaching of film studies are cost, quality and speed of encoding the material from VCR to MPEG.

The number of film and television undergraduate courses offered in any one year by the Department of Visual Arts is around eight. One feature length film or equivalent would be screened each week in each of these courses. The encoding costs and storage requirements for such a large volume of material would be beyond the means of the average University department's budget. It was generally agreed that, at this stage, video on demand was not a viable or even desirable alternative to videotape or laserdisk for screenings.

Lecture and seminar preparation may involve staff screening a mass of material in order to make general comments about it (but not necessarily screening it) during the lecture and/or browsing a wide variety of materials to select excerpts to` illustrate particular points they might wish to make. The content of some courses differs markedly from year to year, especially those dealing with television or contemporary film, hence it is not possible to isolate a body of regularly used material that can be encoded once and guaranteed to be useful for teaching thereafter. Again the cost of encoding and the storage needed for such a large volume of material are major deterrents.

Decisions about what is to be screened can not always be made sufficiently well in advance to allow time for encoding of the appropriate excerpts. The speed and ease of encoding is therefore a major consideration. While some form of quick (if not realtime) encoding from VCR to MPEG may be seen to be essential, the quality of this encoding can be quite low.

The quality of encoded video images was a concern for many of the participants of the trials. The material currently used in teaching and research varies in quality enormously (from home videos through to high quality commercially released videos and laserdisks). In comparison with the average standard of analog materials, the digital video was of acceptable quality, however it did not compare well to high quality videotape or laserdisk. The opinion was that some improvements in the quality of encoding was essential.

There was some disagreement amongst participants as to whether the quality of the material was suitable for lectures. Overall it was felt to be adequate only for student viewing. Since the material used in the trials was encoded from a VCR recorded from television broadcasts , this is not surprising. There was some concern over MPEG encoding artefacts, which seemed worse in animation material with its limited number of colours and hard lines than in images with natural colour. Other MPEG artefacts which were noticeable and distracting to viewers included blockiness and 'tearing' along the bottom of the image and jerkiness. Whether there are encoding or network artefacts needs to be determined through further investigation. The quality issue is one suitable for investigation in further trials.

One issue which was not considered during the trials was copyright. The legalities of encoding video to be used for teaching as opposed to research are unclear as are the implications for a video on demand system. Are royalties paid based on the number of users who might be accessing the material at any one time, or are they paid for the single copy held in the database? Is there a difference between individuals accessing the video independently and the video being shown in a class?

4.3 PC Issues

Several issues were raised in relation to the effects of watching video on a PC rather than a screen.

The first was the Windows interface. Even for experienced PC users, the interface appeared simple but was actually confusing and difficult to use. For general student use, the interface needs to be made fool proof. The Windows bar on the screen was seen to be a distraction and users suggested there be a way of removing it. More control was also required over the sizing of the video window. Other desirable features for the client software were colour adjustment, ability to extract stills from a sequence and running of multiple sequences concurrently.

For viewing film, the ideal scenario is one where the near-darkness of a cinema minimises distractions and allows the viewer to be dominated by over-life size images and sound. Watching a film or a computer screen clearly does not have the same impact or psychological effect as the viewer is always conscious of the medium instead of being immersed in it. For some trial participants this was not necessarily a disadvantage as they felt it encouraged close analysis of film form because one was so conscious of it. Others however expressed reservations about this way of viewing film. There was the perception that being so close to the screen exaggerated camera movement and that colours available through the PC were somewhat lifeless compared with analog video.

4.4. Other Issues

Occasionally in some courses, materials are screened which may be described as controversial. For obvious reasons, some form of security such as password or student number might be needed to restrict viewing of videos to students enrolled in the course.

Digital still images have been used by art historians in the Department of Visual Arts since 1994. The demand for increased image quality has grown rapidly with familiarity and with access to high quality display devices. A similar response to digital video images from the Department's film scholars could be expected once the novelty of the computer screen wears off. Given the demand for higher quality can be anticipated, it might be desirable to encode as a high rate to create an archive file, and then derive a medium to low resolution working image for use in the short term.

5. Conclusion and Further Trials

Overall the reaction from participants in the trials has been positive and some role for this technology in film studies teaching is clearly envisaged, the most likely use being student purposes. The use of the technology for lectures is tied to the issue of video quality and access to a large volume of material. Quality could be the subject of further trials. The single biggest barrier identified so far is the speed and cost of encoding. Further trials are planned for 1996. These involve installing video clients at Caulfield and Clayton Campus libraries and providing video on demand from a large capacity server located at Clayton. Issues for investigation include implementation and useability. It is anticipated that the trials will be extended to include other interested groups in the University.

References

[1] Branch, P., Tonkin, B. "Video Services for a Multicampus University". Proceedings of the Australian Telecommunication Network and Applications Conference, 1994, DEC, 1994, pages 59-64

[2] Le Gall, D. "MPEG: A Video Compression Standard for Multi-media Applications". Communications of the ACM Vol 34, No 4 April 1991 pages 46-58

[3] Tinkler, D., Smith, T., Ellyard, P., Cohen, D., "Effectiveness and potential of state-of- the art technologies in the delivery of higher education". DEET Occasional papers series commissioned by the Committee to Review Modes of Delivery in Higher Education. AGPS, Canberra, 1994.

Getting the Job Done: Distance Learning in the RAAF

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In recent years the philosophy of Open Learning has emerged as a possible future for education and training in Australia. Open Learning can be considered as an umbrella term which refers to a whole series of varied educational initiatives and approaches (Kember, 1995), the most commonly known approach is that of Distance Education. It provides greater flexibility and access to training and education than traditional classroom based approaches. Organisations adopting the philosophy can refer to many successful working examples as a guide on which to model themselves. However, with all this growth in Open Learning there still exists a need for specialist training systems to meet specialist training requirements.

The Royal Australian Air Force (RAAF) is a unique organisation that conducts the majority of its own training for its personnel located right across Australia and the rest of the world. It performs a role that no other organisation in Australia performs, its mission being to prepare for, conduct and sustain effective air operations to promote Australia's security, and therefore has a unique training requirement and a clearly defined need for a specialised training system. The 1990's have provided many changes for the RAAF and strategies are needed to face these changes with confidence.

In the early 1990's there was a shift towards using distance learning approaches with the formation of Base Training Centres (BTCs) and the establishment of local facilitators for technical trade restructure training. These initiatives were to employ technology to supplant some face-to-face instruction with computer-based instruction, but a capability to retain human-human interaction through electronically linking directing staff with remote students was not evolved (Wallace, 1993). Modern computer and communications technologies offer the capability of providing human-human interaction between dispersed geographic locations but at a large cost.

Studies undertaken within the RAAF showed that conferencing strategies have wide application within the RAAF as long as a centralised system was established. This system could be centrally coordinated and shared by all providers of training and therefore would offer turn-key access to defined conferencing functions and achieve efficiencies by the spreading of costs over many users (Wallace, 1993).

The studies led to a proposal for the establishment of a system, the RAAF Distance Learning System (RAAFDLS). This system will be an electronic infrastructure that will support the electronic delivery and management of training to all RAAF establishments and thereby realise reductions in the cost of effective training (RAAF, 1995).

This paper will discuss the issues involved in implementing a unique training system, using the RAAFDLS as a case study. Before discussing these issues a brief overview will be given of the RAAF Training System, the RAAF concept of distance learning and where it is intended to be used.

The RAAF Training System

The aim of RAAF training is to provide RAAF personnel with the skills, attitudes and knowledge necessary for them to do their jobs effectively (RAAF, 1991). The RAAF philosophy of training encompasses the following four components:

a. the systems approach to training,
b. continual improvement,

c. quality recruitment and selection, and
d. individual responsibility. (RAAF, 1991)

The RAAF system is managed to ensure effective and efficient use of resources. Management of the system includes:

a. training manpower management — the conduct of basic and post-graduate training, manpower categories (the training force and the trained force), course manning and manpower cost of training,
b. strategies and authorisations — mustering training strategies, graduation requirements, syllabuses, instructional strategies and testing strategies for each mustering/ trade group;
c. scheduling and tasking — planning, centralised training schedules and unit-scheduled training,
d. resource management, and
e. evaluation and control. (RAAF, 1991)

The fundamental elements of the RAAF training system mentioned above apply to all instructional strategies used and therefore do not change when considering the implementation of a distance learning system.

Profiling the Needs

An individual's training in the RAAF commences from the point of recruitment where each individual undergoes basic induction training lasting for approximately 12 weeks. Basic training for officers is conducted in Melbourne and airmen basic training in Adelaide. On graduation from basic training graduates are sent to the relevant Defence training establishment to receive their job specific training, eg pilot, clerk, technician. Job specific training is that training that a person requires to qualify in a trade or profession. This training can take up to a year to complete at the schools located at different Defence establishments throughout Australia. These schools also conduct other post-graduate training in a range of non-job specific skills, which are required in many different professions or trades during the course of a persons RAAF career.

With the types of training outlined above it is obvious that RAAF personnel spend a considerable amount of time travelling to where the training is being conducted. This travel takes people away from their workplace for a considerable amount of time and also costs a lot of money as travel and accommodation must be provided. Also, schools can only program a certain number of courses per year and therefore it cannot be guaranteed that RAAF personnel will receive the necessary training by the time they need to apply the skills. Such cases illustrate the potential for productivity problems. In some cases personnel receive training so late that they have already learnt how to do the job on the job before they attend the course. However, there is no guarantee that they will have correct job skills without appropriate training.

A system that allows RAAF personnel to gain access to training at their workplace when it is needed and at the right time, for both them and their immediate employer, should be able to overcome some of the identified problems with the current system.

What is Distance Learning?

The basic idea behind distance learning is the separation of teacher and learner which distinguishes it from traditional face-to-face lecturing (Keegan, 1980). Distance Learning is identified in the RAAF as a strategy for organising learning and teaching, as well as an attempt to improve access to learning (Wallace, 1994). Training at a distance is not a new concept for the RAAF, they have been conducting individual courses using the paper-based correspondence method for many years. In recent times major structural changes with the Airforce have identified a need to redefine the RAAF's distance learning strategy and expand the use of distance learning to provide just-in-time training that is cheaper and less manpower intensive to deliver.

Adopting a new distance learning methodology that utilises emerging technologies, for selected courses, has the potential to provide the following benefits identified as essential to RAAF distance learning:

a. manpower efficiencies as a lower instructor/student ratio is required for distance learning.

b. just-in-time training as personnel can obtain training at the time the training is needed for successful performance in the job.
c. cost-savings as less travel and accommodation expenses are incurred.
d. flexibility as personnel receive training at their and most importantly their unit's and section's convenience.
e. time savings as no time is wasted travelling to and from the training.
f. productivity gains as personnel become effective in the job sooner.

In 1992, a restructure was carried out of all the technical trades in the RAAF and as a consequence formal training was reduced from a maximum 18 months where an airmen would graduate as a technician to a maximum 20 weeks where they would graduate as a mechanic and gain their technician status over 2 to 3 years through distance learning. The distance learning is carried out on the job and at Technical Distance Learning Flights (TDLFs), especially established at each RAAF base for this training. The TDLFs are equipped with computers and technical equipment and have instructors that facilitate and support the students in their self-paced distance learning courses. This implementation saw the emergence of 'just in time' training and saw airmen become productive in the workforce a lot sooner than previously.

The restructure of the technical trades was followed by a restructure of the non-technical trades and an adoption of a distance learning methodology for some training. Unfortunately, resources that were provided for the technical trades, such as TDLFs, were not available for the non-technical trades. Headquarters Training Command (HQTC) therefore saw the need for a RAAF-wide distance learning system and established an agency whose task was to develop a proposal for a RAAF-wide distance learning system, RAAFDLS. This system would make use of technical media: print, audio, video or computer; to unite teacher and learner and carry the content of courses (Kember, 1995).

RAAF Distance Learning System (RAAFDLS)

In order to determine what sort of an infrastructure the RAAFDLS needed to accommodate all of the training needs in distance learning, and to what extent distance learning would be used, it was necessary to survey the training providers and ask them what they needed and what they would use if it was available. Even though most were inexperienced in the area of distance education, every training provider was surveyed and asked basically two questions:

a. what courses have the potential to convert to a distance learning methodology? and
b. what methods and media could best be used to deliver the course?

The use of technology was seen as essential to the infrastructure of the new system. Ceri (1986) stated that new (information) technologies themselves provide the best means for coping with training needs. The list of potential technologies that could be used was endless and the following is a list of educational technologies currently used in Australia for Open Learning that were considered:

a. Computer Mediated Communication (eg. Deakin and Charles Sturt University, Victorian Directorate of School Education)
    - email
    - bulletin board systems
    - computer conferencing
b. Audio (eg. WA Distance Education Consortium, Queensland Open Learning Centres)
    - audio-conferencing
    - radio
c. Computer Based Learning (eg. OTEN, SA DETAFE, University of Wollongong)
    - computer base training (CBT)
    - interactive multimedia
    - hypermedia
    - computer-managed learning (CML)
d. Video conferencing (eg. Telecom, UNE, NT Batchelor College)
e. Storage media — optical disk (eg. NRMA, NSW TAFE Library services)
    - CD-ROM
    - CD-I
    - interactive videodisc (OTEN, 1994)

In surveying the different RAAF training providers it was necessary to provide them with a list of what educational technology would be available in order to give an idea of what was possible. In developing the list it was necessary to determine the potential disadvantages of distance learning, such as lack of interaction, and identify technology to overcome these (Black & Cowan, 1988). The list consisted of equipment for data conferencing (CMC), voice conferencing, video conferencing and computer-based learning (CBL), but ultimately the technology that would form part of the system would have to be justified in terms of potential usage and cost.

The Criteria of Efficiency

There was a very positive response to the survey and a number of courses were identified by the training providers as having potential for conversion. The savings in converting the recommended courses, just in terms of travel, were calculated to determine the potential savings across all courses.

A figure was then calculated on what it would cost to provide the technology that would be needed for the system. An essential feature of the system was cost-effectiveness, as research has shown that media and communication technologies which have proved to be efficient, at least for some educational purposes, have often not been able to justify their place because of relative costs (Blom, Krane & Rekkedal, 1988). In order for the system to receive funding approval, the cost of the equipment needed to be recouped in savings in training in the shortest possible time.

The two figures were compared to generate the potential for cost-savings in implementing the system. It was thus determined that video conferencing could not be justified in terms of cost and initial benefits. Once the RAAFDLS was fully operational the need for video conferencing could be re-assessed and funding requested if there was more demand and costs were lower. Without video conferencing the cost of the equipment could be recovered in savings in training in two years.

The proposal for the RAAFDLS would provide the following services:

a. data conferencing (CMC),
b. delivery of computer based learning (CBL),
c. voice conferencing, and
d. computer-managed learning (CML).

The above services would enable students to:

a. communicate with their teachers and fellow students via their computers and voice conferencing equipment,
b. gain access to teaching materials such as lecture notes and assignments via their computer, and
c. have access to many of the information sources easily accessible to students who attend formal classroom teaching. (Black & Cowan, 1988).

In order to provide the services mentioned above the following equipment would be purchased:

a. 48 Multi-media PCs
b. 160 Classroom PCs
c. 19 voice point speakers
d. 52 modems
e. Air Force Training Information System (AFTIS) software.

The above equipment would see a minimum of 2 Multimedia PCs, 8 Classroom PCs and 2 modems per RAAF base. The equipment would provide the following:

a. Multimedia PCs — will provide a standard configuration for which materials featuring graphics, text, sound and video may be developed. These PCs are fitted with CD-ROM drives.
b. Classroom PCs — will provide a standard device configuration for which courseware featuring graphics, text, sound and video may be delivered, and may be used for instructor-led activities such as Office Automation training.
c. Voice point speakers- will provide voice conferencing through defence telephone lines.
d. Modems — will enable access to the RAAF Training Bulletin Board Service that currently provides electronic data transfer, messaging and bulletin broadcast within defined forums as an interim support measure until the AFTIS is fully operational.

e. AFTIS software- will provide a distributed database and data communication system with functions to support the remote delivery and management of training. (RAAF, 1995)

The RAAF is currently in the process of establishing a wide area network (RAAFNET) that will see the majority of PCs, including those of the RAAFDLS, connected by the end of 1996. This would allow PCs to speak to each other no matter where they were located in the country. The AFTIS software would make use of the RAAFNET by being housed on a PC that connects into it. This PC would be the server for the RAAFDLS and would be located at Headquarters Training Command (HQTC) RAAF Distance Learning Agency (RAAFDLA), at Point Cook in Victoria.

The RAAFDLA was specifically established to manage and administer the RAAFDLS and its resources. The agency's responsibility is to completely focus their efforts on providing the system so that training providers can concentrate solely on developing training for this with little worry about the technology. The presence of the agency also provides a way in which to standardise the distance learning which is being distributed throughout the RAAF.

As well as the RAAFDLA, Base Training Centres (BTCs) that will administer the distributed local RAAFDLS resources were established at each base. The staff at these centres would employ standardised procedures to assist local students to access the RAAFDLS. The centres can be seen as the support service that is normally provided by other institutions when delivering distance or open learning courses.

Training providers would liaise directly with the RAAFDLA at HQTC to distribute any computer-aided instruction or register any courses or students on the system, and liaise directly with BTCs for use of computers or voice conferencing equipment.

Management of RAAFDLS

The RAAFDLA has been established for two personnel, a System manager and the AFTIS database controller. It is the responsibility of the RAAFDLA to implement as well as manage the running system. This includes formulating and promulgating the following:

a. a configuration management plan,
b. policy and procedures,
c. guidelines for developing training courses that will be delivered by the system, and
d. proposals for future equipment purchases.

The configuration management plan is a plan to manage the configuration of the RAAFDLS resources during their life. The RAAFDLA will ensure that any training developed to run on RAAFDLS resources will run and therefore it is essential to ensure that the configuration of all resources remains the same. Any changes that are made to the configuration by the RAAFDLA will be done to all computers at the same time.

The formulation of the policy and procedures will prove to be a difficult task because the system is so unique. The RAAFDLS policy and procedures need to detail:

a. a description of the system and a statement of the principles,
b. statements of objectives and action to achieve those objectives, and
c. specifications on what is to be done and how to do it. (Holdaway, 1992)

With such a large proportion of resources distributed throughout the country it is imperative that policy and procedures are detailed enough to ensure the resources are being put to proper use and the system operates at its optimum level. As the system grows procedures will change and in some cases it will be from lessons learnt. The main responsibility of the RAAFDLA here is to monitor the progress of the system and seek constant feedback from training providers, students and other users.

Producing guidelines for the development of training for the system is a very important aspect from the training providers point of view because experience using the available technology is in short supply within the RAAF. An important goal of the system is for it to broaden with time and provide development opportunities for those using it (Blom, Krane & Rekkedal, 1988). The key to quality training is still good trainers (Pelton, 1988) and therefore it is essential to consider the needs of the trainers developing courses for delivery by the system. In a lot of cases the training will evolve and become more effective as lessons will be learnt. The role of the RAAFDLA in this process is to ensure that lessons learnt early on are disseminated so that the development process becomes as painless as possible.

In discussing all the RAAFDLS issues there has been no discussion of the impact of this new system on the students. Personnel within the RAAF are no strangers to change but a lot of them have matured with a traditional training and education system. Just as a large proportion are struggling to come to terms with technology in the workplace, it can be expected that a similar amount will have problems with the RAAFDLS. Support services will have to be made available to students by training providers to ensure the success of training at a distance. The RAAFDLA will discuss issues like these with providers before any training takes place on the system.

When the current system is fully operational a review will be conducted to evaluate the effectiveness of the system and identify areas where change is required and improvements can be made. New technologies are emerging everyday and their relevance to the system will need to be explored. Training providers will be encouraged to provide feedback and suggestions of services that they would like the system to provide.

Summary

The RAAFDLS was developed as a specialised training system to meet the unique and special requirements of the Royal Australian Air Force. The lessons learnt by the RAAF in establishing this system are already being used by the Royal Australian Navy in the development of a Flexible Delivery System and will no doubt come in use to the Army in the near future.

Ultimately, the success of the RAAFDLS depends on its use and the RAAFDLA will continue to work hard to provide a system that meets the needs of both training provider and student (Dolan, 1995). The key to success of the Agency will be its continued reflection on the processes it is employing to provide the system, and continued research into potential improvements of the system.

Bibliography

Black, J.P., Cowan, D.D., Dyck, V.A., Fenton, S.L., Knapper, C.K and Stepien, T.M. (1988). Portable Computers and Distance Education. Developing Distance Education — papers submitted to the 14th World Conference in Oslo, August 1988.

Blom, D., Krane, A.G. and Rekkedal, T. (1988). The NADE media and technology project: New ways of supporting distance learners in Norway. Developing Distance Education — papers submitted to the 14th World Conference in Oslo, August 1988.

Ceri, S. (1986). New Information Technologies. A Challenge for Education. (Paris: OECD report).

Dolan, J.R. (1995). Distance Learning — The RAAF Distance Learning System. RAAF Training News — Training for Air Power, June 1995.

Holdaway, E A.(1982). The Relationship between Research and Policy formation in Education, Education Policy Making in Australia, Australian College of Education, 1982.

Keegan, D. (1980) On Defining Distance Education. Distance Education, vol 1, no 1, 1980, pp13-36.

Kember, D. (1995). Open Learning Courses for Adults: A model of student progress. Educational Technology Publications, N.Y.

OTEN (1994). Technology Survey Report — Educational Technologies 1994. Open Training and Education Network, technology Updates 1.

Pelton, J.N. (1988). Technology and Education: Friend or Foe? Developing Distance Education — papers submitted to the 14th World Conference in Oslo, August 1988.

RAAF (1991). Manual of Training Policy and Procedures. DI(AF) AAP 2002.001. Commonwealth of Australia.

RAAF (1995). RAAF Distance Learning System Configuration Management Plan. Commonwealth of Australia.

Wallace, P.R. (1993). The Potential Use of Remote Conferencing in Support of RAAF Training. Commonwealth of Australia, May 1993.

Wallace, P.R. (1994). What is Distance Learning? The Personnel Journal — The Personnel Journal of the Royal Australian Air Force, issue 9, September 1994.

Distance Teaching With Vision

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This short article describes a desktop videoconferencing project trial begun in July, 1995 between teachers at the Open Access College and:

- *a family of three students living on a station in remote South Australia.*
- *two medically disabled students in metropolitan Adelaide*

Teaching the curriculum by distance education to these students usually involves contact with their teachers by telephone or HF radio once a week with students posting their written work for marking and comments. Often the time for the round journey of posting in, marking and posting back can take between 2-4 weeks. Teachers make face to face visits to their students only once or twice a year.

Research into desktop videoconferencing in 1994 indicated it could be used successfully to improve the quality of interaction between students and teachers and to improve the quality of learning concepts and processes difficult to teach in the non-visual mode of distance education.

Desk-top videoconferencing incorporates videophone technology on a computer. When teachers make a desktop videophone call with ShareVision™ they simultaneously talk, see their students and interactively share a whiteboard or computer program *all over one ordinary telephone line.*

In the project trial we placed computers running ShareVision™ into:

- the homes of two students enrolled with the OAC as medical conditions precluded them from attending face to face lessons in a DECS school during 1995 and 1996. One student was studying secondary subjects and the other a combination of primary and secondary. The ShareVision™ computer remained with each student for a period of at least one semester.
- another ShareVision™ computer was placed into a family of three primary aged students living on a station in remote South Australia. Students were taught during 1995 from teachers at the Marden Campus and in 1996 by teachers at Port Augusta School Of The Air Campus.

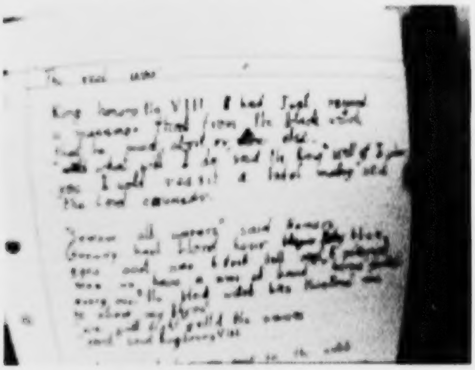
OAC teachers and the students were trained with teachers beginning regular delivery of ShareVision™ lessons during Term 2 and 3, 1995. Most lessons are 30-45 minutes in duration. Subjects being taught include Year 1 Language, Year 6/7 English Language, Year 6/7 Maths, Year 6/7 Society and Environment, Year 9 Maths and Year 9 Society & Environment. Over 60 lessons have been delivered to the students during the trial. Lessons are usually delivered once per week from a ShareVision™ workstation in the OAC.

ShareVision™ installed on a desk in the student's bedroom

Project Objectives

One of our main aims has been to monitor if learning is being made more personal and easier for students through the use of desktop videoconferencing. We did this through the use of questionnaires and both formal and informal interviews with teachers and students using ShareVision™.

We wanted to determine if desktop videoconferencing offered improved learning opportunities for concepts and processes that have traditionally proved difficult to address in the non-visual mode of distance education and where limited movement video input is required viz. showing case-study material, presenting information requiring high quality still graphics etc.



A student holds up a draft of an assignment they have completed in front of the ShareVision™ camera and takes a snapshot for their teacher to immediately see and interact with the work.

We also hoped to see if desktop videoconferencing encouraged more meaningful teacher-student interaction empowering the students and advancing the equity between the two.

Another objective dealt with issues of student management in the distance mode. We wanted to learn if desktop videoconferencing could deal more efficiently with the tendency for some students to withdraw or become non-participatory in lessons. The visual presence of others who are geographically distant creates a strong sense of social presence and may create the warm environment which some need.

Parents and supervisors also had a means to videoconference with teachers providing them with a more meaningful role in the learning partnership.

Outcomes

OAC teachers and students all say that the 'face to face' contact achieved with ShareVision™ and the increased interactivity this and the whiteboard generates is what sets it apart from other technologies used in distance education.

Remote and Isolated Students

The students on the outback station each believed they received better contact with teachers. Hugh, the youngest (Year 1) had for the very first time, the opportunity to share important things in his life like drawings of himself, his dog and swimming pool with his teacher Miss Lynn and get immediate feedback. He was able to put letters together to make words and associate and draw pictures with those words given the visual and audio encouragement from his teacher much faster with ShareVision™ than using telephone lessons and posting in written work. Hugh generally detests schoolwork but would always be ready and willing to participate in ShareVision™ lessons. His progress was promising in 1995 according to his teacher and his mother who is the home supervisor of all her children's schooling with the OAC. Unfortunately, telecommunications infrastructure problems have restricted the number of successful ShareVision™ lessons to Hugh in 1996.

Hugh's brother, Charlie in Year 6 had difficulty in some literacy skills, particularly spelling. His teacher was able to view and correct his work much faster by having Charlie take a snapshot of his writing viewing it together and correcting it with him on-line. Charlie could see the corrections as his teacher made them and talked to her about them. Corrections could be saved and used in helping with the following week's work.

Charlie's twin sister Emma also in Year 6 received fewer ShareVision™ lessons than Charlie or Hugh but was able to make some use of ShareVision's™ interactive whiteboard to help improve her work in fractions.

Medically Enrolled Students

Both students enrolled with the OAC on medical reasons and using ShareVision™ have exceeded all our expectations. The student using ShareVision in 1995, although very restricted in movement with a serious physical disability had enough functional capacity in his hands to use the mouse and make valuable contributions to Maths and Society & Environment lessons using tools on the whiteboard. It was extremely heartening to know ShareVision™ was improving the quality of his life. He was extremely well organised, helpful and really looked forward to his weekly lessons with ShareVision™.

The second medically enrolled student using ShareVision in 1996 is also making full use of its features, preparing answers to work on the whiteboard for his teacher to check and give immediate feedback on. Though diagnosed with ADD his concentration span in using ShareVision™ is significantly longer than using traditional print and audio technology in learning.

Other

Another outcome of the ShareVision™ project trials has been the impact the technology has made on the teachers delivering to students with it. Many of the teachers using ShareVision™ had little/no experience in using computers at the beginning of the project but they are now competent and literate with the technology. This enthusiasm has overflowed to other teachers and to other forms of technology use in the Open Access College.

ShareVision™ is also enabling a closer contact between parents and teachers. It provides the means for home-based supervisors (usually parents) to take a more active role in their child's education.

Teachers' comments include:

> *'The immediate response to student work makes teaching more relevant.'*

> *'Being able to talk through concepts and check for immediate understanding makes learning more personal and interactive.'*

> *'Using ShareVision as a tool for modelling work gives me a strategy which more closely emulates face to face teaching.'*

> *'For the first time I am actually teaching Charlie rather than responding to him.'*

> *'Its so good to be able to see Menno's face — I can tell whether he understands or not without having to wait until assignments are posted in'.*

while students have said things like .....

> *'It was good and lots of fun. I liked seeing Miss Lynn, We played games. It was good to tell news and draw pictures of what we were talking about and she could see it.'*

> *'Its been fun and I have learnt a lot too.' ShareVision is an excellent program for school and we could also sell sheep on it.'*

> *'It was good that I could use maps so quickly and see how to do my Maths. I couldn't do it on paper — it would take me a long time'.*

> *'ShareVision was very good. I could see my teacher and what he was doing. I once was having trouble with my fractions so Mr McTaggart rang me up on ShareVision and showed me how to do it. If we had not had ShareVision my teacher could only have told me how to do it over the phone and I would probably have got it wrong any way.'*

A home supervisor of students using ShareVision had this to say:

> *'I think there is a great future in using ShareVision for non school-based students. Though it will probably won't replace correspondence the extra help it gives gifted or slow learners is marvellous. We have found it wonderful for solving problems. It is time consuming though. When my mother did her schooling there was never any contact with schools. She really did it on her own no matter what the problem. Now we have the telephone, radio and a remote teacher 'face to face' for part of each week with ShareVision.'*

Issues

The one real concern in using ShareVision™ with Hugh, Emma and Charlie but beyond the scope of the project was the problem 'making the link' as often as we wanted due to the inability of the telecommunications infrastructure to support the technology. This was despite the homestead being on a telephone landline. When links were successful they were always at the lowest end of the bandwidth possible (7200 kbps). Sometimes line quality became unacceptable during a lesson resulting in the breakup of the 'live video'. component to ShareVision™. When this did occur and Hugh, Charlie or Emma only managed to see a still image of their teacher, the audio component of ShareVision™ always held up and the lesson became audio only until the connection re-established itself. This problem continues today as the students receive ShareVision™ lessons from teachers at Pt Augusta School Of The Air.

A close-up view of the computer monitor showing a snapshot in the larger whiteboard work area and the smaller remote and local video windows on the left hand side.

Conclusion

The project is already effectively meeting its objectives for improving the quality of learning to these students. It is reducing student's isolation and improving their quality of learning.

In particular, desktop videoconferencing is:

- enhancing the learning experiences of students disadvantaged by their geographical location or medical disability
- increasing the effectiveness of the teacher's lesson material to be delivered
- offering excellent opportunities for sharing visual concepts and getting an immediate response
- a tool for modelling work
- interactive, easy, enjoyable and fun to use

- allowing college-based supervisors to participate more meaningfully into their child's distance education teaching and learning.

Desktop videoconferencing is making the quality of learning for these students far superior to any other more traditional form of distance education they were receiving even 6 months ago. The project trial is continuing and funding is being sought to expand the project. A ShareVision™ workstation costs in the order of $5000. For more information about this and other projects using technology in distance education at the OAC, direct your www browser toward the OAC home page

http://www.saschools.edu.au/open_acc/open_acc.html

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Profiling Computing Coordinators

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The role and responsibilities of the Computing Coordinator in secondary schools is dynamic. Historically, Computing Coordinators have been selected from the teaching ranks of schools. To date there has been no large local, systematic study of the role, responsibilities and characteristics of the Computing Coordinator. Consequently, schools have had to make decisions based heavily on hearsay or anecdote or rely upon information that reflects circumstances based on U.S.A. experience.

This paper represents a first attempt to provide meaningful information on the functions and attributes of Computing Coordinators in NSW secondary schools. Data examining these aspects of the Computing Coordinator position were collected using survey techniques from 66 of 141 targeted non-government secondary schools located in metropolitan Sydney. Computing Coordinators from government secondary schools were not included. The survey was divided into five sections. This generated large amounts of data, of which parts relating specifically to the role, responsibilities and characteristics of the Computing Coordinator are reported here.

Data collected from closed questions were coded and analysed descriptively and inferentially using Microsoft Excel and SPSS for Windows. Data from open questions, where appropriate, were coded and analysed using Microsoft Excel.

The study identified 12 trends as representative of the sample. Based on these, 5 recommendations are made to promote a more professional perspective to the role of Computing Coordinator.

Background

From modest beginnings in the 1980's, N.S.W. secondary schools have gradually embraced computing technology. Schools have invested considerable amounts in hardware and software to meet emerging curriculum trends and ensure the efficient management of clerical and administrative resources. As technology continues to be assimilated, the need to manage evolving computing systems emerges as a priority for schools.

The people responsible for managing school computing resources — student networks and related courses, and possibly administrative networks — have become known as Computing Coordinators. When secondary schools first established the position, they frequently opted, often by default, for the Computing Studies teacher. These teachers were perceived to be experts because they may have had some background, knowledge, experience, or interest in computers.

Unfortunately, the process did not always promote adequately equipped individuals with appropriate qualifications, training, or experience to manage resources efficiently. In most cases, the people had to acquire the necessary skills on the job (Handler, 1990) and many well intentioned decisions were made without accounting for whole school needs (O'Mahony, 1995).

Once appointments were made, schools to their credit, recognised the need to support Computing Coordinators. N.S.W. government secondary schools for example, commonly budgeted the equivalent of a head teacher's administrative allowance — six forty minute periods per week — to support the management of computing resources. This model received official recognition with the release of Computer Education Program Guidelines and Funding for Classroom Application (1989), which guaranteed funds for three years to support a 240 minute per week staffing entitlement.

Private sector schools, have had to cope with similar problems. Unlike government schools, non government schools (especially the non systemic Catholic schools), have greater flexibility to employ people with particular expertise, especially if a need arises beyond the current capacity of the school. O'Mahony (1995) identified a number of fee paying schools where the position, Computer Services Manager was created to meet new circumstances.

The Computing Coordinator is an established position within N.S.W. secondary schools and all have come to rely upon them heavily. Despite this reliance, there is little local data profiling the position. Information about personal characteristics, experience, qualifications, and the functions performed is scarce. By developing a profile, schools can use the emerging schema to formulate approaches that best meet their needs.

Review of the Literature

A thorough search using the ERIC and AIS databases failed to uncover significant evidence of research focusing on Computing Coordinators in Australian schools. Only one paper containing a role description of a Computer Services Manager in a number of N.S.W. non government schools was located (O'Mahony, 1995).

A search of annual conference papers of professional associations supporting Computers in Education, located occasional references to the position, but none aggregated the personal characteristics, experience, qualifications, and functions performed by Computing Coordinators in N.S.W. or Australia into one study. The Computer Education Coordinator's Kit (1987) developed by the Computer Education Unit of the N.S.W. Department of Education, does outline the responsibilities of the position, but not the characteristics of those in the position.

It is possible to locate some research dedicated to personal characteristics, experience, qualifications, and functions performed by the Computing Coordinator, however, it is not Australian, originating instead, from the United States of America.

The Characteristics of Computing Coordinators

In the mid to late 1980s a number of US studies (Barbour, 1986; McGinty, 1987; Martinez & Mead, 1988) indicated that Computing Coordinators were in general, older and more experienced male teachers. Barbour for example, found that District Coordinators were on average 43 years old, had been teaching for 18 years and using computers for 4 years. School Coordinators were slightly younger (38 years), with proportionately less teaching experience (13 years) but had been using computers for a similar period (4 years).

Most Computing Coordinators have come from Mathematics, Science and Business Studies backgrounds, few having completed degrees in which there was a Computing major (Handler, 1990). Martinez and Mead (1988) established that only 9.5% of Computing Coordinators had an undergraduate major or minor in Computer Science, although 59.8% had completed some post-graduate study in Computing. McGinty (1987) discovered that 80% of Computing Coordinators were Education graduates.

The typical preparation for Computing Coordinators has consisted of self taught knowledge (Handler, 1990) with possibly one or two courses in computer programming (Morsund, 1985). Morsund found that most Computing Coordinators had only modest levels of computer oriented technical knowledge, usually less than that obtained in a Bachelor's degree. According to Martinez and Mead (1988) over one third of Computing Coordinators (35.7%) reported the majority of their computer training occurred within a teacher education program, while others were either self-taught (26.2%), received instruction through inservice (10.2%) or from a TAFE institution (1.5%), or developed understanding through work experience (1.6%).

Similar data is not available for secondary school Computing Coordinators in N.S.W. Woodcock (1992), in a survey of Western Sydney primary and infants teachers' computer training found that 36% had learnt about computer education through on the job training, while 10% had received no formal training. Other categories reported include self taught (19%), college course (16%), and inservice (13%). When discussing future needs teachers identified an increasing role for on the job training (40%), self teaching (28%) and inservice activities (26%).

Responsibilities of Computing Coordinators

The responsibilities of Computing Coordinators vary from school to school. However, throughout the literature there are functions which every Computing Coordinator performs.

Computing Coordinators invariably maintain links with classroom teaching. McGinty (1987) found that 90% of United States school based Computing Coordinators were actively engaged in classroom teaching. Handler (1990) also found that Computing Coordinators were planning curriculum based activities, not only for students but also for teachers in relation to computers, whilst still teaching.

Many different tasks are expected of Computing Coordinators. While there is great variety in what been reported, often the tasks amount to performing similar functions. Typically, coordinators are responsible for a school's hardware and software (Hancock, 1990; Handler, 1990), with more than 70% indicating that maintenance and purchase are prime functions (McGinty, 1987).

Other responsibilities include: mentor to students and role model to teachers (Hancock, 1990); planning and implementing teacher inservice (Handler, 1990: Morsund, 1985; McGinty, 1987; Sanders, 1991; Strudler & Meredith, 1988); technical support for students and faculty (Hancock, 1990; Morsund, 1985; Sanders, 1991; Strudler & Meredith, 1988); systems backup (Morsund, 1985; Sanders, 1991); supervising computer laboratories (Hancock, 1990; Morsund, 1985); strategist to the Administrator and Supervisor, catalyst to overcome teacher resistance, successful promotion of computer use (Hancock, 1990); administration and development of computer programs, keeping up with new developments, working in administrative level activities, planning teacher inservice (Handler, 1990); planning and implementing programs, writing grant proposals (McGinty, 1987) scheduling classes, overall system administration, maintaining contact with sources of information, developing evaluation procedures, budgetary and financial responsibilities, facilitating change (Morsund, 1985); support for day to day operations, and training, data planning, documentation of data management systems, data recovery (Sanders, 1991); resource adding, initiating and facilitating change (Strudler & Meredith, 1988); planning, purchasing, designing, writing, installing, converting procedures, rewriting programs and training (Trotter, 1993).

Method

A questionnaire was developed based on the literature and distributed to Computing Coordinators in 141 non government secondary schools located in metropolitan Sydney. In general, metropolitan Sydney extends from the Pacific Ocean in the east to the foothills of the Blue Mountains in the west, and from Hornsby in the north to Port Hacking in the south. Nine schools were not included in the distribution because they either serviced small student populations (less than 150) or their clientele was very specific eg. the Japanese School.

Questions were grouped into sections. The relevant section for this paper was section D, Computer Administrator / Coordinator Information. This section sought information about the nature of the person holding the position of Computing Coordinator ie. their gender, age, training, qualifications, teaching status, years teaching, years teaching Computing Studies, current teaching load computing experiences, designation, and functions performed.

In Section D a total of 13 questions were asked, a number of which contained two to four parts. This produced a total of 24 responses. Of these responses, 15 were to closed questions containing between two and sixteen possible stems. The remaining 9 responses required a short written answer.

All responses to closed questions were allocated a number code for statistical analysis. For open ended questions, two procedures were used. For those questions where respondents where giving similar answers, the responses were number coded. For those questions where there was little consistency across responses, these were recorded manually and this data then analysed.

Number coded data were entered into an Excel spreadsheet. This was used for descriptive purposes and to generate tabular and graphical information to be reported. The Excel spreadsheet was then converted to SPSS for Windows format for additional statistical analysis.

Results

1. The Schools

Responses were received from 66 (46.8%) of the 141 non government secondary schools sent surveys. By far the largest group to reply were schools affiliated with the Catholic Church (32 schools). Other religious denominations reported were Anglican (9 schools), Uniting (4 schools), Adventist (2 schools), Baptist (2 schools) and Jewish (2 schools). Thirteen schools identified themselves as non denominational or without religious affiliation. Two schools did not respond.

Data provided, enabled schools to be further classified. It was found that 46 schools catered for a single sex (27 for girls, 19 for boys), while 20 were coeducational institutions. The schools operated as day schools (48), as schools catering for both day students and boarders (15) and as boarding schools (1) only. The schools could also be categorised as systemic Catholic schools (centrally administered and operated by individual Catholic dioceses, of which there were 25) or independent schools (essentially high fee paying, traditional grammar-type schools based on the English public school model, of which there were 41).

2. The Computing Coordinator

2.1 Personal Characteristics

Computing Coordinators responding to the survey were overwhelmingly male. In this sample 71.2% of Computing Coordinators were male and only 27.3% female. This might suggest that the position is one not normally occupied by women, despite the high proportion of female teachers in N.S.W. secondary schools. Furthermore, given the response of single sex girls-schools (40.9%), affirmative action has not overly impacted upon the position of Computing Coordinator. The figure contrasts markedly with those obtained from the United States. Nearly a decade ago, 48% of school based secondary Computing Coordinators were female (McGinty, 1987).

Gender	No of Schools	Percentage
Female	18	27.30
Male	47	71.20
No Response	1	1.50
Total	66	100.00

Table 1 — Gender of Computing Coordinators

The gender imbalance prompted a question about whether or not there were differences in the work of male and female coordinators. Using data on gender and functions performed, a t-test for independent samples was conducted. A mean difference of 0.1583 with 53 degrees of freedom was calculated, but this was not considered to be significant at the 0.5 level. Based on this result, a null hypothesis cannot be rejected.

The average age of Computing Coordinators in this sample was calculated to be between 30 and 40 years. This figure is similar to information obtained in earlier United States surveys. Barbour (1986) estimated average age to be 43 years, McGinty (1987) 40 years and Martinez and Mead (1988), 39.3 years.

	Age of Computing Coordinators
Average	39.46
St. Dev.	8.63
Median	35.00
Mode	35.00

Table 2 — Computing Coordinator Age

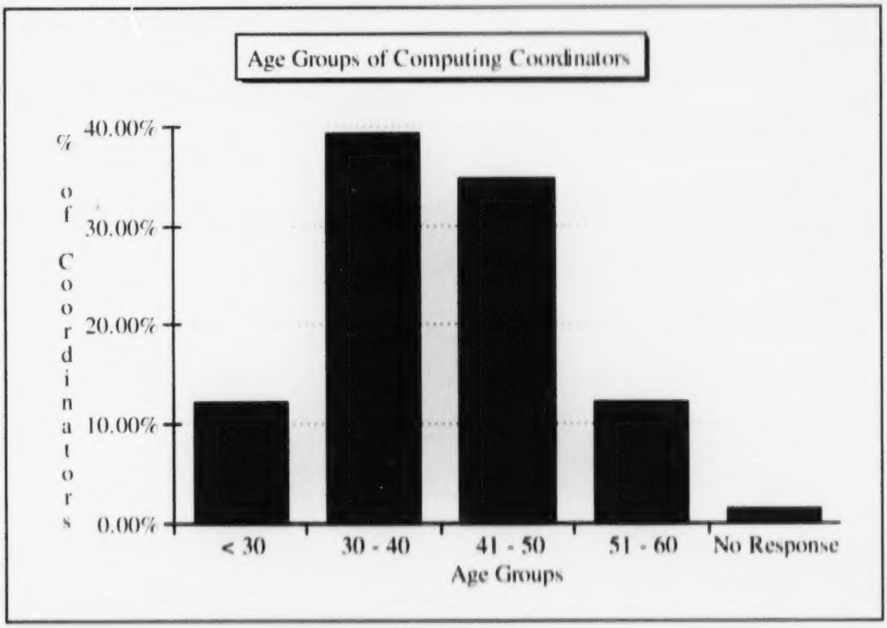

Figure 1 — Age Groups of Computing Coordinators

2.2 Training and Qualifications

A majority of Computing Coordinators (68.2%) indicated they were self taught with respect to computers. In addition, 49.2% indicated they had some tertiary qualification in computing. Less than one in five coordinators (18%) indicated they obtained their training from inservice. A small percentage received their computer training through work experience (7.6%), or TAFE (1.5%). In the United States, by way of contrast, coordinators were more likely to have a tertiary qualification (35.7%) in computing, than to be self taught (26.2%).

Post-secondary qualifications of Computing Coordinators indicates great diversity in the background of these people, with a high percentage holding multiple qualifications. The most frequently reported undergraduate credentials were in Education, Science and Mathematics. In the United States similar findings have been reported. Handler (1990) stated that most Computing Coordinators had Mathematics, Science or Business Studies backgrounds, while in a study of school based coordinators conducted by McGinty (1987), 80% of respondents held a qualification in Education. Interestingly when reported, initial teacher education training (undergraduate degree or diploma) is aggregated it appears that only 47% of Coordinators possess a teaching qualification. While the study used only non government schools, a higher proportion would have been expected, given that only one respondent indicated they were not or had not recently occupied a teaching position!

Training	YES	Percentage	NO	Percentage
Self-taught	45	68.2	21	31.8
Inservice	12	18.2	51	81.8
TAFE	1	1.5	62	98.5
Tertiary	31	49.2	32	50.8
Work Experience	5	7.6	58	92.4
Other	1	1.5	63	98.5

Note: Due to multiple responses percentages add from left to right not top to bottom.

Table 3 — Computing Coordinator Training

			Degree					
Area of Qualification	Diploma		Bachelor		Masters		Doctoral	
	No.	%	No.	%	No.	%	No.	%
Education	17††	25.8	11	16.7	6	9.0	0	0.0
Teaching	3†	3.0	0	0.0	0	0.0	0	0.0
Ed Computing	5††	7.6	0	0.0	5	7.6	0	0.0
Science	1	1.5	15	22.7	5	7.6	1	1.5
Computing	2	3.0	2	3.0	0	0.0	0	0.0
Maths	2	3.0	11	16.7	2	3.0	0	0.0
Arts	0	0.0	4	6.1	1	1.5	0	0.0
Others	10	15.2	7	10.6	2	3.0	0	0.0

† Undergraduate Diploma †† Postgraduate Diploma

Many Coordinators specified more than one qualification (as requested). The percentage shown relates to the total number of coordinators not the total number of responses.

Table 4 — Computing Coordinator Post Secondary Qualifications

Eighteen of the 66 respondents (27.2%) also held a Masters degree or higher, but only five were in Educational Computing. In all, 10 coordinators (15.2%) possessed a postgraduate qualification (diploma or degree) in Educational Computing. This situation contrasts with United States data (Martinez, 1988) in which 59.8% of coordinators had completed postgraduate study in Computer Science.

2.3 Teaching Experience

Table 5 indicates that in addition to the responsibilities of being Computing Coordinator, 92.5% of respondents were also engaged in classroom teaching. A similar statistic (90%) was reported in two separate United States studies (McGinty, 1987; Handler, 1990).

Teaching	**No. of Coordinators**	**Percentage**
Yes	61	92.5
No	3	4.5
No Response	2	3.0
TOTAL	66	100.0

Table 5 — Current Teaching Status

Only 3 people reported they were full-time coordinators. One had been seconded from the teaching staff to the full time position, another was re-employed within the same school in the capacity of Systems Administrator, while the third had no teaching background, being employed directly from industry. In addition, two schools reported other people were appointed to technical support positions (one full time the other on the equivalent of $^{7}/_{8}$th teaching load) as support personnel for the Computing Coordinator.

Years Teaching	**No of Coordinators**	**Percentage**
< 5	5	7.6
5 - 10	12	18.2
11 - 15	18	27.3
16 - 20	16	24.2
> 20	13	19.7
No Response	2	3.0
TOTAL	66	100.0

Table 6 — Years Teaching

Computing Coordinators who where qualified classroom teachers, had on average, 13.7 years teaching experience. In the United States (McGinty, 1987), Computing Coordinators who were qualified teachers had on average 17 years experience.

Almost all Computing Coordinators (88.9%) have taught some form of Computing Studies for between 1 and 14 years (average 5.4 years), with 63.6% having taught the subject for seven years or less. Data collected in 1987 for the U.S.A. (McGinty, 1987), indicated Computing Coordinators had taught Computer Studies for 5 years. One would suspect a somewhat higher average today.

Response	**No of Coordinators**	**Percentage**
Yes	58	87.9
No	7	10.6
No Response	1	1.5
Total	66	100.0

Table 7 — A Computing Studies Teacher

Computing Coordinators were asked how they came to be involved with the Computing Studies syllabuses. Many had expressed an interest (16.7%), some volunteered (15.2%) and a number were asked (13.6%). Other teachers indicated they had applied for the position, retrained, were the most experienced, or 'were in the wrong spot at the wrong time!'

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Responses	No of Coordinators	Percentage
Asked	9	13.6
Volunteered	10	15.2
Interested	11	16.7
Most Experienced	5	7.6
Applied	6	9.1
Retrained	2	3.0
University course	3	4.5
No one else available	3	4.5
No Response	17	25.8
TOTAL	66	100.0

Table 8 — Involvement with computer studies

Based on teaching experiences data and, that the first formal N.S.W. syllabus in Computer Studies (Computing Studies Yrs 7 to 10) was introduced in 1987, it would appear most Computer Studies teachers trained, at least initially in other subjects. This statement provides additional support to the earlier statement that most Computing Coordinators have backgrounds in disciplines other than Computing, a position supported by Handler (1990).

2.4 Computing Experience

When asked about computing experiences outside of education, 69.7% of Computing Coordinators responded they had not had any outside experience. A small number had part-time or full time experiences and these ranged from consultancy work to systems engineer to retail sales and management in the computer industry.

Those Computing Coordinators not currently teaching or not qualified to teach, were asked to state their computing experience, however, many teachers also took the opportunity to indicate their experience. Responses are shown in Table 9.

2.5 Designation

When asked about designation, 39.3% responded they occupied a position titled Computing Coordinator. However, 28.7% indicated they either held a number of different titles in relation to their work with computers, had no specific title, role or job description, or their title was not one of those indicated in the survey, eg. Director of Computing, Manager — Information Technology etc. Barbour (1986) found that 21% of respondents in a United States study held the title of Computing Coordinator. Other titles reported in that study included Media Specialist, Educational Systems Administrator and Microcomputer Consultant. As with this study, those appointments fill the role and function of what has become known as the Computing Coordinator, although titled differently.

2.6 Functions

Fifty one Computing Coordinators or 77.3% indicated they received a teaching load reduction for carrying out the responsibilities associated with the position. However, 12 respondents (18.2%) indicated they were expected to manage and administer the school's computer networks in addition to a full time teaching load. For those receiving a teaching reduction, the average was six 40 minute periods — equivalent to the administrative loading for a head teacher. The three full time respondents were omitted from this analysis. Overall, the results are similar to those of McGinty (1987) who found that 90% of Computing Coordinators still held teaching responsibilities, a position supported by Handler (1990).

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16 years in Computing	Set up Administrative Network
Involvement in an ANN project	Technical Support
7 years teaching Computing	Worked Honeywell Controls
Bachelor of Computing Science, Teaching Commercial Data Processing at TAFE	5 years hands on system and application at school
Installation of Administrative System	Trained on Deca PDP II from 1978
9 years of slow painful learning	Systems Manager TAFE
Taught Computing Studies courses since 1991	3 years Apple //e, 7 years Macs, 6 years DOS
Taught computers in Engineering at International School	Programming in M Ed course, manipulation of data for statistical packages, teaching
Consulting	Software Developer
IBM Multimedia Project	Repairs
Accounting	PC Trainer
Network Manager	Systems Engineer
Retail Sales & Management	15 years of bits and pieces
1 year at Macquarie University and a course in COBOL at UTS	HSC Marker, 2U syllabus committee, MECSTA committee member
Computer Science — University	Self taught Macintosh, DOS/Windows
Teaching 8 years	Teaching 6 years
Taught Computing Studies 11 years	Post graduate training in Computing
None	Partial completion B Sc Computing
Diploma in 1988, teaching Computing Studies since 1981	MS Word Thesis production, VAX and On-line medical index use

Table 9 — Computing Experiences

In general, Computing Coordinators stated they used more than their allocated time release to manage school computers, with 21.2% stating they used twice the allocation, 19.7% three times the allocation and another 24.2% who used in excess of three time the allocated time release. Handler (1990) reported that in addition to teaching staff and students, part time coordinators have many if not all the same responsibilities as full time coordinators, who find a 40 hour week insufficient. One full time coordinator indicated there were times when it takes up to three times the allocated time to complete all the required tasks. While some might suggest this is a time management issue, it is however indicative of the nature of the role of Computing Coordinator.

Interestingly, only five individuals reported they used only the time allocated or less to fulfil the functions of Computing Coordinator. From conversations with a number of these coordinators, it was established that other factors contributed to their response. For example, one Computing Coordinator had a full time technician to maintain hardware, while another was in a school where there was a full time Manager of Information Systems in addition to a full time technical officer.

Computer Coordinators were asked to identify tasks associated with the position. A list of sixteen tasks was provided along with the opportunity to record additional examples. The tasks and response rates are contained in Table 10.

Task	Yes	Percent	No	Percent
Teaching Students	52	82.5	11	17.5
Administration of Stand Alones	49	77.8	14	22.2
Administration of Student Net	47	74.6	16	25.4
Administration of Teacher Net	32	50.7	31	50.3
Administration of Admin / Clerical Net	27	42.9	36	57.1
Evaluating and Purchase of Hardware	54	85.7	9	14.3
Evaluating and Purchase of Software	57	90.5	6	9.5
Installation of Hardware	51	81.0	12	19.0
Installation of Software	58	92.1	5	7.9
Maintenance and Repair of Equipment	54	85.7	9	14.3
Training of Staff	55	87.3	8	12.7
Technical Support — Teaching Staff	54	85.7	9	14.3
Technical Support — Admin / Clerical	35	55.6	28	44.4
Develop, Implement, Evaluate Policies	56	88.9	7	11.1
Develop, Implement, Evaluate Programs	50	79.4	13	20.6
Supervision of Computer Laboratories	50	79.4	13	20.6
Other	14	22.2		

Table 10 — Functions of the Computing Coordinator

Of the 16 tasks listed, 13 recorded greater than a 70% positive response. Only the administration of the administrative / clerical network scored less than a 50% response. A response rate of 55.6% to the task of providing technical support to administrative and clerical staff would tend to confirm that less than half of the Computing Coordinators support both curriculum and administrative computing needs.

The administration of a teacher network also scored lowly. Only 38 schools (57.6%) reported the existence of a teacher network. When this information is coupled with high responses to the Administration of Stand Alone Computers, Installation of Hardware and Software, Maintenance and Repair and the provision of Technical Support to Staff, it is not surprising that Computing Coordinators spend significantly more time than allocated to the role.

Tasks other than those on the list provided are also completed by coordinators. Examples of other duties include:

Primary School Comp. Coordinator	2
Boarding House Comp. Coordinator	2
Teaching comp. in other subjects	1
Student Elections	1
DUX calculations	1
Programming	1
Computerised Timetable	1
Liaising with Suppliers	1
Negotiating Maintenance Contract	1
Technology planning	1
Adviser	1
Visiting other School Systems	1
Working with Information Manager	1
Everything related to computers	1
GOD	1

Table 11 — Other Functions of Computing Coordinators

Few teachers would call upon a colleague for advice about purchasing a calculator, a pair of running shoes or a power drill, however 87.9% of Computing Coordinators indicated they were regularly called upon outside of normal working hours (59.3% of respondents said more than once a week) to give advice to a member of the school community on the purchase or maintenance of computers. Being a Computing Coordinator brings with it the burden of expert on 'everything to do with computing'.

Trends

A number of trends emerged in the data collected. The trends in part define a broad profile of current Computing Coordinators. They are:

1. The majority of Computing Coordinators are male (71.2%).
2. There is no difference in the range or number of tasks male and female Computing coordinators are expected to complete.
3. The average age (39.4 years) of Computing Coordinators is between 30 — 40 years.
4. The majority of Computing Coordinators (92.5%) retain classroom teaching responsibilities.
5. The majority of Computing Coordinators (51.5%) have taught between 11 — 20 years.
6. The majority of Computing Coordinators have taught Computing Studies (88.9%).
7. Computing Coordinators have taught Computing Studies between 0 — 14 years, averaging 5.4 years.
8. Computing Coordinators have come from Science, Mathematics and Education backgrounds. Very few have formal qualifications in Computer Science.
9. The majority of Computing Coordinators indicate they are self taught with respect to computing. However, some have undertaken formal education in order to increase their qualifications in this area.
10. The majority of Computing Coordinators (69.9%) have no industry experience related to Computing.
11. The majority of Computing Coordinators (77.3%)receive a period reduction to perform their responsibilities.
12. Only 7.6% of Computing Coordinators indicate they use less than or the amount of time allocated for their responsibilities. The remainder, 92.4% use two or more times the allocation given.

Conclusion

Computer education is a much publicised, high profile innovation in schools. It would be safe to assume in 1996 that few schools have not incorporated computing in some form either in the curriculum or for administrative purposes. Despite its diffusion, schools continue to face difficulties supporting computer based innovation. The position of Computing Coordinator is vital to the diffusion process. Without their assistance and enthusiasm many teachers would not be able to successfully integrate computers into the curriculum. In the light of these statements and the information generated by the study the following recommendations are made:

1. More women should be encouraged to become Computing Coordinators, to provide role models for girls and to balance the view of males and females in technology education.
2. Computing Coordinators should negotiate the responsibilities of the position, accountability and administrative time allocation before accepting or reaffirming themselves in the role. Once done, a role statement should be published to ensure that Computing Coordinator time and skills are utilised appropriately.
3. Schools should continue to support Computing Coordinators through teaching load reductions. Schools should explore ways of matching the available allocation to the workload to promote proactive rather than reactive responses.
4. Schools should promote training opportunities for Computing Coordinators to broaden their skill base and to enable them to stay abreast of rapid developments in Computing.
5. Computing Coordinators should be encouraged to broaden their qualification base in both the fields of Computing and Educational Administration.

Bibliography

Barbour, A. (1986). Computing coordinator survey. *Electronic Learning 5* (5), 35 — 38.

Board of Secondary Education. (1987). *Computing studies syllabus years 7 — 10.* Sydney: Author.

Hancock, V. E. (1990). Promoting secondary school computer use. A coordinator is the key. *International Conference of Technology and Education*. Brussels, Belgium. ED327143

Handler, M. (1990). *Computing coordinator network: Filling a collegial void.* ED322112.

Lamon, W. E., & Sammer, J. (1989). *Microcomputers in secondary schools. Oregon's coordinator's perceptive*. ED 323991.

Martinez, M. E., & Mead, N. A. (1988). *Computer competence: The first national assessment*. Princeton, NJ: Educational Testing Service. ED341375

McGinty, T. (1987). Growing pains. A portrait of an emerging profession. *Electronic Learning, 6* (5), 18 — 23.

Morsund, D. (1985). *The computing coordinator*. Eugene, Oregon: International Council for Computers in Education. ED256297

O'Mahony, C. (1995). *Measuring school information systems management.* School of MPCE. Macquarie University, Sydney.

NSW Department of Education. (1989) *Computer education coordinator's kit*. Sydney: Author.

NSW Department of Education. (1989) *Computer education program guidelines and funding for classroom application*. Sydney: Author.

Sanders, J. (1991). Departmental computing coordinators leverage resources. *Cause/Effect, 14* (1), 31 — 35.

Strudler, N. B. & Meredith, D. (1988). *Successful change agent strategies for overcoming impediments to microcomputer implementation in the classroom*. American Educational Research Association, New Orleans. ED298938.

Trotter, G. (1993). Ordering out for info. *The American School Board Journal*, Sept. 39 — 42.

Woodcock, P. & Dailhou, P. (1992). Computers in our primary schools. Who uses them? In S. Wawrzyniak & L. Samootin (eds.) *Kids, curriculum, computers and....* Proceeding of the 9th Annual Conference of the NSW Computer Education Group, Sydney: 175 — 187.

Exploring the multimedia landscape from a training and professional development perspective

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Overview of the landscape

Our society is witnessing a convergence of culture, power blocs, business and technology in ways and with a speed far beyond that of previous times or even prophesied in science fiction novels. The impact of this convergence is felt in almost every aspect of our lives. This paper will focus on the impact of multimedia on the areas of training and professional development .

Over the last twenty years motherhood statements about learning for life can be found in policy speeches as well as academic papers. In the early years it was seen as a desirable goal for the enrichment of our society. However now it is not an optional direction but rather an essential responsibility for the corporate, education and social elements of our society. The need for regular, flexible and continuous learning is apparent for participation in society generally as well as specific professional and technical fields.

The corporate environment has made a substantial commitment to staff professional development over many years.

> Systematic professional development and training has been a feature of the corporate world for many years. It may take the form of a one day workshop to introduce some new technology or management strategy. Or it might be a two day residential course offered in another city. Often at the same time as the new training is provided, team building strategies might be used to advantage. There is already tremendous expertise in training for professional development and life long learning in industry. (Nott, 1996.)

More latterly a partnership has developed between industry and TAFE colleges to deliver workplace based training often using computer assisted learning modes as the instructional design and delivery format. Swinburne TAFE has worked with Alcoa Australia, Mayne Nickless, Ajax Fasteners, Nestle, Tatura Milk Industries and the Department of Education South Australia. Western Metropolitan TAFE has worked with Don Smallgoods, GMH, United Dairy Farmers and the Victorian Racing Commission. All of these training programs have used CAL principles for the framework and delivery.

Within Australian academic institutions, training of undergraduates in particular skills has always been a feature. However there is now a more conspicuous move to address training using a variety of delivery modes. This is exemplified by the creation of the Science, Multimedia Teaching Unit at the University of Melbourne which is designing CDRom and Internet training programs for students. Deakin University likewise is a leader in the delivery of distance education using digital information.

Within the general education arena, EDNA (Education Network Australia), a Federal and State initiative, seeks to promote online education in the higher and vocation training and school sectors. The Directorate of School Education in Victoria is planning to use its website — **SOFWeb** to deliver professional development to teachers.

The scope of the multimedia training delivered via computer assisted learning packages encompasses training which provides text, graphics, photograph animation, video sound and interactivity in combinations previously unavailable by traditional training and professional development methods. That is not to say that the use of multimedia in training overwhelms all traditional training strategies. Rather it offers extensions and in some instances replaces some of the most expensive or least effective segments of those traditional methods. Computer assisted learning can be presented via the World Wide web, CD Rom packages and disk based training packages.

It is important at this stage to define the term multimedia and to clarify its relationship with another term used extensively through this paper- Computer Assisted Learning or CAL.

CAL = multimedia + interactivity

where Multimedia refers to text, graphics, photographs, animation, video and sound and Interactivity is a programmed response to a user action other than basic navigation (moving backwards and forwards). Therefore (and this can be used in product evaluation), material for development in CAL form should deliver more than is possible with videos and books. For example, an electronic encyclopedia in its basic form is an example of multimedia and not CAL. It essentially only allows the user to navigate to different sources of information which can contain visual and aural elements. This could be done with video recorders and books, albeit far less conveniently. However, what does make an electronic encyclopedia CAL is its marvellous searching power, searching and retrieving information in ways not possible with video recorders and books.

Why is multimedia taken up by training and education bodies?

The move towards the use of multimedia to facilitate effective and cost efficient training and professional development has grown at a substantial pace. The motivation for embracing this mode for the delivery of professional development and training lies in the recognition by Universities or TAFE Colleges, Industry or Education systems that they have both a responsibility and vested interest in assisting graduates and employees to participate in lifelong professional development.

Specific reasons for this approach can be ordered under the following themes:

Costs

The total cost of an instructional program is equal to the combined costs of development and delivery. Multimedia based instruction tends to cost less for delivery and more for development. Instructor led instruction tends to cost more for delivery and less for development. Given a large enough population of learners to offset the high development costs, multimedia based instruction is cheaper to run than instructor led instruction.

Time saving

Industry experience shows that the majority of students complete a CAL course, having met the objectives, in significantly less time than with conventional courses. This is called "learning compression" and is becoming widely accepted as an important factor in justifying the use of computers in learning. Trainees usually find that CAL is much more demanding and intense than traditional approaches. Research reports seem to indicate that mental exhaustion sets in after two or three hours of CAL, which is likely to be the equivalent of a full day in regular classes.

It is a generally accepted rule of thumb that multimedia based instruction reduces instruction time by around 50 percent. Two possible reasons for this reduction are better instructional design and options to omit content that is not needed by the learner. This has particular relevance for industry as it reduces the amount of down time for staff.

Interaction

Computer assisted learning offers students the opportunity to learn through exploration rather than through tightly structured directed learning experiences. Research has shown that instructional techniques based on passive presentation methods- classroom lectures, videotape- result in very little actual learning, perhaps a few minutes in every hour. Most of the time the trainee is not attending to the instruction. In interactive, individualised instruction, the trainee spends a very high percentage of the time attending and hence learning.

Immediate Feedback

This has a beneficial psychological effect on learners since they have immediate knowledge of the adequacy of their performance. Where the performance is inadequate, CAL provides an opportunity to make good that deficiency.

In addition, a well designed program will not only explain why an answer is incorrect, but also reinforce correct answers because the learner may have guessed.

Consistent presentation

Trainers can become bored with presenting the same material repeatedly. They can have "off days" and days off through illness. They can also lack in-depth knowledge of parts of the subject that they are teaching or may place unnecessary emphasis on those aspects of a topic with which they are more familiar.

The "expert" on the other hand may be a poor instructor finding it difficult to teach the course. The use of multimedia can standardise course presentation. A well designed multimedia course is brought to life once and then used over and over again, possibly with only minor updates. Also, the best ideas over time can be incorporated into the course, creating an electronic "expert", one which can continually accept input for improvement.

Improved Management

Learner progress can be monitored and guidance given very effectively by incorporating computer managed learning (CML) into multimedia based projects. There is also potential for reducing the time spent by instructors on correcting test papers if appropriate sections of these papers are computer based.

CML affords a powerful method of establishing accurate records of trainee performance since the computer can automatically keep track of items such as:

dates when study was carried out
the time spent in each session
analysis of responses to each question.

By analysing group statistics, faults or weaknesses in course design can be accurately determined because a sound computer based course can give access to the responses to any question asked during the course.

Analysis of student answers is a great boon to improving course quality and responsiveness to individual learner viewpoints. If, for example, a particular learner obtains 40% on a test, a summary listing of his answers using CML may reveal that he spent an inordinate amount of time on questions 3, 5 and 11 and got them wrong anyway.

Other student records may now be accessed and it could be found that 90% of all students spent a lot of time on those questions, some answering correctly, some incorrectly.

It would now be clear that either of two situations exist:

the questions themselves are confusing
the material relating to those questions was not well presented

In either case, the action to be taken is well defined.

Change management

Content may change frequently. Non computer based systems and printed manuals cope with change awkwardly. Those parts of a course on computer can be updated very rapidly, particularly if there is a centrally located data source. If a computer based course has printed material associated with it, the more volatile material should be on the computer with the more static in printed form.

Flexible delivery

Often trainees or students have particular constraints on their availability. A computer in the workplace or at home can be used for instructional purposes day and night, often reducing onerous needs for travel.

This flexibility is important as learners can use odd times to study. The same situation applies to self study texts, but it often seems that sitting in front of a computer to learn is more acceptable and motivating than studying a self paced text.

By embarking on a course of instruction, learners with widely differing starting skills are expected to attain the same level of competency. The self paced nature of computer based materials means that the more knowledgeable will complete the course without becoming bored, while those with little starting knowledge will progress at their own pace without becoming lost. This is a motivating aspect of computer assisted learning.

Computer assisted learning also provides greater opportunities for practice compared to formal instruction. The computer is immune to tiredness and irritability in the face of persistent requests for "another go".

Safe practice

A computer is able to simulate real life situations with safety, allowing for experimentation and providing guidance on request. This particularly strong form of interactive CAL presentation is termed "simulation". Additionally, a lot of practical training has a low student/teacher ratio. CAL simulations can provide a one to one practice environment.

Privacy

Less knowledgeable learners are often inhibited from asking questions in formal classes, particularly involving more academic subjects. There is no stigma attached to repeating and reviewing sections of a CAL course.

Instructor Availability

Occasionally this can be the factor that offsets most others. If training is crucial and instructors are not readily available, the initial effort that is put into developing a CAL course may be justified even if the target population is small. This aspect becomes more important the greater the lead time involved in bringing a new instructor on line.

Professional Development and Training on the Web

Whilst most computer assisted learning packages are currently delivered using disk or CD Rom format there is significant experimentation with the Internet. The Internet and more specifically the World Wide Web offers a slightly different perspective on the design and delivery of computer based learning. "The Web supports multimedia and also the potential for the user to interact with it in ways that may enhance learning." (Nott, 1996) The advantages that have been identified earlier can be expanded.

Computer assisted learning has offered to the user the benefit that it can be delivered at times convenient to the user, whether that be in the workplace or at home. The Web extends that notion of any time any place. The equipment requirements of a networked computer at work or a computer with modem and telephone connection means that the training can occur at the discretion of the user and be delivered from anywhere around the world. Updates of material or email communication with the course supervisor can occur regardless of the time or the location of the supervisor. Not many supervisors enjoy phone calls at 6.00 in the morning but an email message sent at that time allows communication convenient to both parties.

Training and professional development on the Web enables a different level and scope of collaboration and team building because participants can communicate, share and work together regardless of their location. The variety of communication strategies available over the Internet have been built into the World Wide Web enabling video conferencing, computer conferencing, electronic mail exchange, as well as participation on news services and bulletin boards. These facilities provide users with much higher levels of interactivity and feedback than can be experienced elsewhere.

Whilst it is not all plain sailing with Internet based training it does offer another option for the delivery of multimedia computer based learning and it is likely to be the area of greatest research and development over the next five years.

Differences between Education and Industry based training

Industry is concerned with Return on Investment

Education is concerned with Student Pass Rate

The objective of industrial training is to transfer learning to on-the-job skills

The objective of education is to improve knowledge, develop general skills such as analysis, research, problem solving in a general sense, not necessarily aimed at a particular vocation. In some ways, distinctions between education and training are blurred and not necessarily useful. For example, if I'm studying Accounting at a university, am I being educated or trained? Does it really matter?

The trend in much industrial training involves the development of problem solving, decision making, analysis and research skills, particularly in those people "lower" down an organisation's structure. Previously such skills were seen as only being necessary for supervisory staff. The quest for "lean and mean", quality conscious organisations has been instrumental in this shift of thinking. Consequently, much training material for industry is now being designed to exercise such generic skills in a vocational setting relevant to a particular industry or industry groups.

There may be a difference in how instructional materials are written for training or educational purposes. People involved in industry training have a wide variety of backgrounds and facility with the English language. This often means that more attention is given to the use of appropriate language levels than is the case in educational institutions, where more complex sentence structures are routinely used. Industry based multimedia projects often include a language and literacy consultant as part of the development team for this purpose.

Training requires that trainees see how the training is going to benefit them and that the new knowledge or skill is going to be immediately useful. Occupational relevance is therefore crucial. This can contrast with the more general purpose educational aims of "improved knowledge and appreciation" in a field of study.

Training is centred around the achievement of "competencies" which the trainee must be given at the outset of training. To quote from The Australian Qualifications Framework :

> (a competency is defined) as the possession and application of both knowledge and skills to defined standards, expressed as outcomes, that correspond to relevant workplace requirements and other vocational needs.
>
> It focuses on what is expected of the person in applying what they have learned and embodies the ability to transfer and apply skills and knowledge to new situations and environments.(p1)

Multimedia development for training purposes is therefore very focussed on vocational outcomes. Educational outcomes on the other hand are usually defined as the content of a particular course, the development of specific skills and the focus is on the requirements needed to achieve the stated outcomes. The relationship between the learning and later usefulness is not necessarily clear.

The difference between multimedia development for education and industry may perhaps best be summarised by referring to the Instructional Systems Design model presented earlier. Education systems usually are only concerned with the arrowed stages whereas industry training takes in the whole sequence.

For example, a very common situation in educational institutions is for a teacher or lecturer to approach a developer with an idea to demonstrate an "interesting" concept. This may be a particular chemical reaction or the principles of triangulation or Newton's Laws of Motion and so on. Much educational multimedia development is based on the premise that "this would be interesting to do". Often, no particular regard is given to the financial viability of the project or whether the instructional aims could in fact be better and more economically achieved via print, or worse still, back in the class room! Proposals for industry training however, invariably begin with the questions: "How much is this training going to cost and how will my employees and my company benefit from it?" The wise developer will be prepared with clear answers to these questions before the first meeting with management.

The Multimedia Development Process

For our purposes, a convenient model of Instructional Systems Design may be represented by the following stages:

Job (Skills) Analysis

The duties and tasks to be performed are identified, as are the required standards of performance.

Training Needs Analysis

Existing job performance is compared to required job performance and the training needs identified. Learning outcomes (course objectives) are defined. A Project Mission statement is developed and hopefully written down!

Develop Instructional Materials

Appropriate media are chosen to achieve the learning outcomes. Instructor-led, self-paced print and computer based components are identified. In multimedia development, this is a particularly critical stage. For example, content which is suitable for class room delivery to a particular group of learners, may not be as effectively delivered by computer assisted means, even to the same group of learners. Therefore, skilled, instructional judgement must be used to carefully choose those content areas which will benefit from computer assisted delivery.

In short, the skill of knowing when to apply what instructional tools is vital.

Instructional materials are prepared.

Assessment

Assessment is student (trainee) centred and determines if they are able to perform the tasks to the required standard of performance.

Evaluation (Validation)

Evaluation is training system centred and determines how well the training itself was designed and carried out in pursuit of the learning outcomes. This stage also tells us how well the learning has been converted to the required on-the-job performance ie. validates that the whole exercise was worthwhile!

Criteria for evaluating Computer Assisted Learning packages.

In assessing the value of CAL programs whether on Rom , disk or via the Internet it is important to view the evaluation from the perspective of the contracting institution or industry body, the multimedia authors, and the users or students.

The contracting institution or organisation are interested in value for money. The suitability of a course or professional development program for CAL delivery as opposed to face to face print based training, depends on criteria such as — instructor time saving, characteristics of the target population, likelihood of change, scope for interaction, currency and ease of updating, management. commercial possibilities and instructor availability. Pre and post delivery evaluation in terms of these criteria will provide one measure of the value of the a training program.

The authors focus on evaluation points such as content, accuracy and consistency of presentation. The purpose of uniform presentation is to make the computing environment as seamless and unobtrusive as possible and to promote trainee familiarity with the way material is presented. The 'tone of voice" of the program should be appropriate to the learners and consistent in style. Instructions must progress with the learner. The learning context must be sufficiently flexible so as to respond to the different learning styles and learning support required by each learner.

> The current feeling is that one can perhaps give control to all of the learners some of the time, and to some of the learners all of the time, but one should probably not give control to all of the learners all of the time. A fundamental instructional design question is to determine what kind of control should be given when. (Naidu, S)

Finally learner based evaluation criteria could include pre and post test results, early identification of learner difficulties, progress and support relative to the needs of the individual learner, content, presentation, clarity, ease of understanding of content and instructions.

To view a more comprehensive analysis of evaluation models for evaluating open learning approaches and associated technologies it is worthwhile visiting the OLTC site which has an annotated bibliography of relevant literature. (http://www.oltc.edu.au/common/new.htm)

Summary

As industry and education strive for improvements in the effectiveness and efficiency of professional development and training new design and delivery modes are being explored. The impact that interactive multimedia programs is having on this area is growing and with the burgeoning of interest and access to the Internet new approaches are being explored further. What is a apparent is that the balance between traditional models of face to face professional development and training and those that are based on interactive multimedia will shift and that latter will become the preferred style for many organisations and institutions.

References

Naidu, S. (1995) "Definitions of Instructional Control in Learning Environments" *Australian Journal of Educational Technology*, 11(1), 12-19.

Nott, M. (1996) "Teaching and Corporate Training on the Web" a paper presented at the Weblink Conference, Indonesia.

Ministerial Council on Education, Employment , Training and Youth Affairs (MCEETYA) (1995) *Australian Qualifications Framework- implementation handbook*. Brisbane: Australian National Training Authority

An Implementation of Interactive Objects on the Web

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Interactivity on the Web has until recently been accomplished with HTML forms and CGI scripts, lacking the responsiveness of stand-alone computer programs and consequently limiting the effectiveness of learning interactions. With the release of ShockWave, MacroMedia Director animations can now be incorporated directly into Web pages to provide high quality animation and interactivity, to support for example, tutorial style questions and instantaneous feedback. This paper looks at the application of this technique in the translation of a 'traditional' computer-based tutorial into an on-line version. Further, a simple authoring front-end to these interactive elements makes it possible to capitalise on the Web's modularity and potential for efficient development and implementation. It is apparent that changes in roles and responsibilities of all participants can result from this approach.

The tutorial, 'Ariadne's Thread', was originally designed to reduce the load on Library staff and lecturers by increasing the library skills of first year Arts students (Jones & Fritze, 1996). It was developed in HyperCard by the Interactive Multimedia Learning Unit of the University in conjunction with University librarians and lecturers from the Faculty of Arts. The main areas of focus were use of the catalogue system and interpretation of reading list citations. Each topic area in figure 1 consists of several screens employing a combination of information and interactive questions. A mythological metaphor supported the navigational structure of the program, providing a 'thread', hopefully *not* mythical, to assist students in making their way through the 'maze' of the Library.

The program was developed and trialed during 1994 and scheduled computer laboratory sessions organised by library staff were first offered to students on a voluntary basis in 1995.

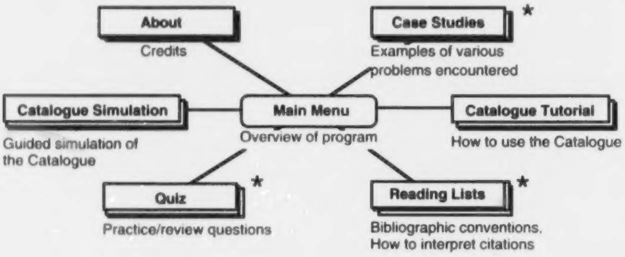
About
Credits
Case Studies
*
Examples of various problems encountered
Catalogue Simulation
Guided simulation of the Catalogue
Main Menu
Overview of program
Catalogue Tutorial
How to use the Catalogue
Quiz
*
Practice/review questions
Reading Lists
*
Bibliographic conventions, How to interpret citations

Figure 1. Topic structure of Ariadne's Thread. (*Topics translated to the Web version)

The Ariadne Collection

In early 1996, replacement of the Library catalogue system made aspects of the tutorial obsolete or in need of review. It was decided to re-purpose the program into on-line format for use within the Library Web site, maintaining the content and style of the original where possible within the following guidelines:

- Topics relating to the new Library catalogue would be left until experience of the new system had been obtained.
- *Interactive elements*, equivalent to the original style of questions and feedback, would be incorporated directly into Web pages as Macromedia ShockWave documents.
- Librarians and lecturers responsible for instructing students should be able to write and edit both the Web pages and the embedded interactive elements.

Comparing the respective structures, it is clear that the same concept of a self-contained program no longer applied - hence the name change from 'Ariadne's Thread' to the 'Ariadne Collection' of Web resources for the purposes of identifying and funding the project.

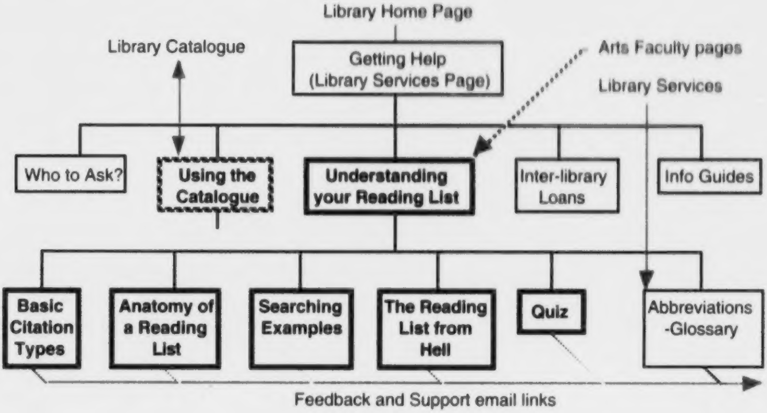
Library Home Page
Library Catalogue
Getting Help (Library Services Page)
Arts Faculty pages
Library Services
Who to Ask?
Using the Catalogue
Understanding your Reading List
Inter-library Loans
Info Guides
Basic Citation Types
Anatomy of a Reading List
Searching Examples
The Reading List from Hell
Quiz
Abbreviations -Glossary
Feedback and Support email links

Figure 2. The Ariadne Collection pages (in bold)

Interactive ShockWave Elements

To provide the interactive question and information operation of the original program, a number of separate MacroMedia Director files were developed and converted to Web-compatible ShockWave documents. These formats included multiple choice, citation identification and classification question styles. Figure 3 illustrates how an interactive question element appears when embedded within a standard Web page, providing a series of exercises for the user to identify appropriate search elements of a given reading list citation. In response to the user actions, selected elements are highlighted, and immediate explanatory feedback or rubber stamp 'reward' given. The user can skip back and forth through a number of exercises in the one question.

While the operation of the question is defined in the ShockWave file itself, the content and feedback is specified in an external text file in the form of question script shown in table 1. This text-based approach to authoring follows from protocol used extensively in producing computer based learning materials in Chemistry (Fritze, 1993). When the Web page is loaded, the ShockWave file retrieves the question script file 'Question.txt' across the network and interprets it to configure the question. Generating a web topic page therefore involves skills little more involved than word processing:

1. creating a traditional HTML Web page with associated graphic links etc. using a Web page editor
2. including a 'embed' statement in the HTML, pointing to the required ShockWave file
3. creating the corresponding question script file in any word processor

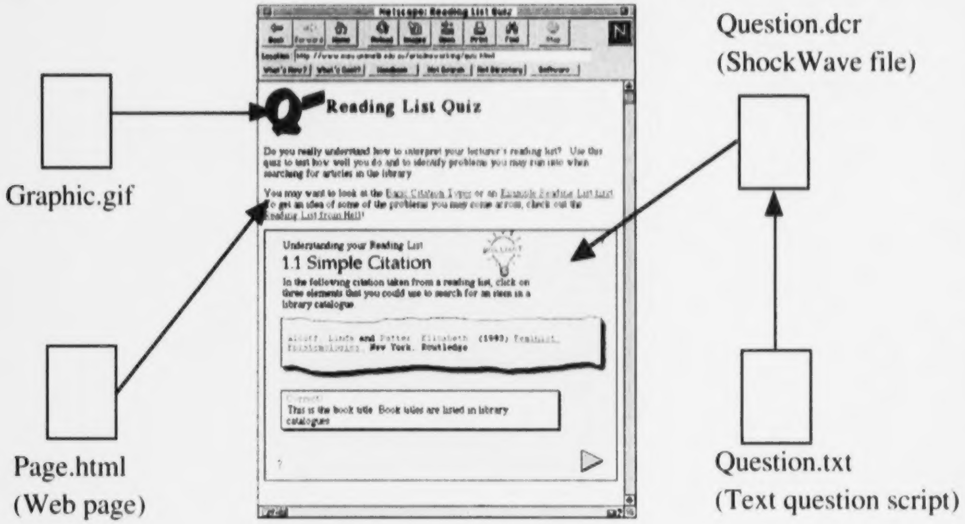

Figure 3. Structure of an Ariadne Collection page

```
SECTION_   1. Understanding your Reading List

QUESTION_  Book Citation
STEM_  "In the following citation taken from a reading list, click on three elements that you
could use to search for an item in a library catalogue."
ACTIVEFIELD_ "Alcoff, Linda and Potter, Elizabeth. (1993) Feminist Epistemologies,
New York, Routledge."
CRITERION_  "Alcoff, Linda", true, "Correct!
Alcoff is one of the book authors. Book authors are listed in library catalogues."
CRITERION_  "Potter, Elizabeth", true, "Correct!
Elizabeth is one of the book authors. Book authors are listed in library catalogues."
....
```

Table 1. Section of interactive question script generated by content experts.

Impact on development and implementation

While the intention was to simply translate an existing tutorial, both the move to Web delivery and the newly created ability for content experts to easily create and modify topic pages and interactive questions resulted in significant shifts in the nature of the project.

Program Design

The design of on-line pages involved active consideration and adaptation of materials beyond those of the actual project. For example, hyperlinks both to and from external Web pages have been created and abbreviations/glossary information from the original program merged with external resources to better service the whole site (figure 2).

A major development component of Ariadne's Thread centred on navigational interface design, involving choice of metaphors, programming, user evaluation etc. This 'packaging', a common feature of many CFL programs, arguably has little direct impact on the educational purpose of the program. In contrast, the Web browser interface provides a standardised navigational framework. Multiple, re-sizeable and extended page views, with efficient scrolling, handles information more efficiently and without the painstaking design and chunking associated with the fixed 640 x 480

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screen format. While the graphics in the original program was not extensive, some additional thought was required to optimise the Web file sizes.

Production

The iterative prototyping approach of Ariadne's Thread was typical of many traditional CFL projects. It could be described as *development-centred*, involving a drawn out, collaborative effort in content design, interface design and programming to produce each prototype (figure 3).

- The development task tended to dominate time and budgets
- Prototype evaluation did not always reflect the experience of implementation
- The production cycle was slow to respond to observed changes in need

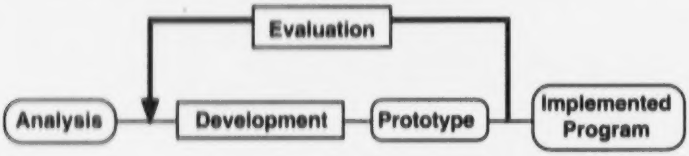

Figure 4. Production cycle Ariadne's Thread.

Production of the Collection on the other hand, appeared to reflect the more modular nature of the materials with the activities separating into two distinct levels, 'expert' and 'situated' (figure 5).

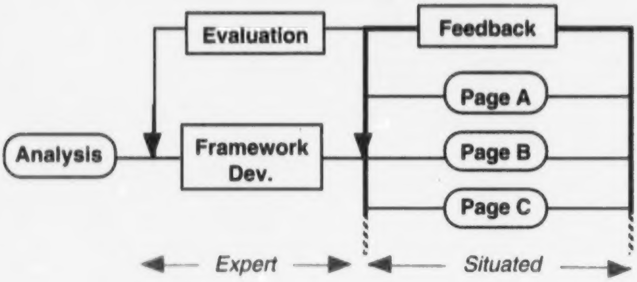

Figure 5. Production cycle of the Collection.

Expert activities involved specialist professional and technical expertise in the design and programming of interactive element mechanisms, formats, network logging systems, templates for pages etc. Output of this activity provided a framework to facilitate the second level of development activities, situated far more within the context of implementation.

Situated activities involved content experts in the on-going process of writing, implementing, reflecting and refining materials. This could be considered an aspect of normal teaching practice.

Implementation

In sixty time-tabled computer laboratory sessions spread over 9 weeks in 1995, only 290, or 15% of the target group made use of Ariadne's Thread. Students attended more sessions early in the semester, the anecdotal evidence being that, at the time of actual need, pressure of studies made sessional attendance difficult. On the other hand, the Collection potentially can be accessed at any time by students from all courses and levels, staff members and even the public. Access could be from home or any of the computer laboratories around the University. There is a distinct change in the nature of the materials here - rather than providing a goal-based *training* solution the observed problem, the Collection has the capability of providing on-demand *performance support* for students. This support has the potential of linking directly from the Catalogue access page.

Moreover, content experts are now able to respond immediately to needs observed within the library or from feedback to the lecturers. It is anticipated that the Collection will continue to evolve in this manner, complementing other Web resources being developed concurrently. With the limitations imposed by the requirements for specialised software and lab-based delivery are removed, it is expected that this responsibility may well extend to increasing numbers of content experts. While computer class sessions may still be organised for the following year, these are likely to include network skills and resources. It is intended that other forms of on-line support will be incorporated, for example email link to enable students to post queries directly to an electronic help desk with responses summarised on a Web page.

In this more 'democratic' environment, questions of ownership and responsibility have arisen which will need to be addressed, for example:

Should the Arts Faculty continue to fund such developments if significant use of the materials is made by 'outsiders'?

How will on-going refinement of materials or hotline support be accommodated into existing budgets and infrastructures?

While the prospect of a publishing a saleable product existed for the original project, what commercial potential does the Collection have?

Will pages of the Collection be identified as such to the user?

Evaluation

The move from scheduled laboratory to open access, on-line delivery means that students' usage patterns have become harder to determine. To assist in this, a Web-based system of gathering detailed audit trails of students' actions has been put in place, and visual mapping analysis of the audit trails will be undertaken in a manner similar to that employed for the original program (Fritze, 1994). Figure 5 indicates that the process of review takes place at two levels. Formal *expert evaluation* will be extremely important in understanding, not only how and when students use these on-line materials, but also how the implementation process itself is progressing. *Situated feedback* will be the key to successful on-going development of the materials, and in the end, most likely to provide evidence justifying continued involvement. It is important that an efficient process of reporting usage patterns and other feedback be made available to content experts as an integral component of implementation. Feedback will be available from such sources as email and help desk queries, detailed records maintained by the catalogue system itself, as well as by questionnaire and focused student interviews.

Concluding remarks

At the time of writing, with the first pages of the Ariadne Collection at implementation stage, a significant change in the nature of a traditional computer-based teaching project is evident - its development and implementation processes and impact on the student learning and departmental infrastructure. This change has been seeded in part by the increased modularity and open delivery of on-line Web materials, and in part by the development of specialised interactive learning devices and support tools. In particular, the shift from 'authoring' to 'writing' tools has shifted the locus of project control from the technical to educational, involving teaching staff more directly in development and implementation. A simultaneous shift from a development-centred project approach to one that is implementation focused, has increased the potential of responding to learning needs on an on-going basis. To capitalise on these opportunities however, changes in the understandings of teaching, development and administrative staff will need to further develop, supported by professional development activity and the continuing evaluation of the current implementation.

Bibliography

McTigue, P. T., Tregloan, P. A., Fritze, P. A., McNaught, C., Hassett D. & Porter, Q.(1995). 'Interactive Teaching & Testing Tutorials for First Year Chemistry'. pp. 466-471, *Proceedings of the World Conference on Educational Multimedia & Hypermedia*, Association for the Advancement of Computing in Education.

Jones, D., Fritze. P. (1996). 'Ariadne's Thread. An interactive computer assisted training programme teaching undergraduates how to maximise their use of the Library OPAC and how to understand the basics of bibliography', pp. 477-484. *Proceedings of the 1996 VALA Biennial Conference*.

Fritze, P. A. (1994). A visual mapping approach to the evaluation of multimedia learning materials. pp. 273-285 in K. Beattie, C. McNaught & S. Wills (Eds.). *Interactive multimedia in university education: Designing for change in teaching and learning*. Amsterdam: Elsevier.

EdMOO : One Approach to a Multimedia Collaborative Environment

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EdMOO [HREF 1] was created in mid 1995 as an environment for teachers to experience the text based virtual reality environment offered by a MOO. It was intended to provide a place for discussing education and training issues, and possibly to be supported by an online document library. This paper describes the growth of EdMOO and its adoption of multimedia artifacts to enhance the communications within the MOO. The development of the Drover [HREF 2] software with programmed extensions to EdMOO permits participants in an online meeting to display documents, graphics, sounds, movies, in fact any of the media supported by Netscape, to others in the same virtual place.

Multiple User Object Oriented Dungeons (Domains) have some tradition in education and professional support. TECFAMoo [HREF 3] and BioMOO [HREF 4] being well known sites with primary interests in education for the former, and support of biological scientists for the latter. The EdMOO project began as a text based MOO for local teachers to use as a meeting place. Rather than make use of existing MOOs, this assumed that Australian teachers would be more inclined to adopt a new system where there was a strong likelihood that other participants were also novices, and whose motives for using the system were likely to be similar to their own. At the time of writing, a number of teachers from Victorian schools are being introduced to EdMOO, and their communications and constructions are to be studied. The research will document the development of the MOO itself, as well as the quality and style of communications with a focus upon the place as a system for professional development support.

It was (and still is) envisaged that the environment of EdMOO would be created and put into a state of frequent change by the participants, as their requirements and programming skills developed. Being realistic about the amount of time that teachers have available has meant a strong focus in the initial stages upon creating useful tools, manuals, and shortcuts.

The Monash Education EdMOO

Latt Epstein [HREF 5] indicates that the nature of the MOO environment lends itself to

> .. highly malleable and rich interactive collaboration space providing interactive(chat), store and forward(mail) as well as posting(mailing list) and news features to its virtual denizens, many of which have incorporated MOO into their daily routine...staying connected to friends, colleagues and other team members all day.

Various issues in the implementation of the "Text Based Virtual Reality" produce problems for the interactive players. These include difficulty in programming objects, and navigating the MOO. Not surprisingly, the development of the World Wide Web has inspired various MOO developers to look at ways of integrating the technologies for the benefit of MOO players. Work at E_MOO [HREF 6] has produced a WWW interface to the MOO, or a least the potential for this, by allowing the MOO server to distribute HTML documents (Web pages) on a separate port. Coppieters of BioMOO [HREF 7] recognises the communications and programming issues, but confirms the communication focus of the environment.

> To use the MOO as simply a provider of web pages is a waste of one of this VR system's greatest strengths: live communication. Second, limitations in the current MOO servers make it difficult to automatically add web manipulation features to all MOO objects, and instead, such object manipulation must be custom designed for each object class. This is expected to be solved by the release of the LambdaMOO server version 1.8.0 sometime in the (hopefully near) future. Until then, most object manipulation is best performed via the telnet window.

Interestingly, similar observations have been made at EdMOO, however the importance of providing a simple and effective means for players to display and simultaneously view multimedia objects was considered paramount. EdMOO operates with rather limited resources. The BioMOO approach to objects presents a powerful interface whereby programmed objects in the MOO can be viewed using the object number. This is in the form http://bioinfo.weizmann.ac.il:8000/99anon/anonview/4715 [HREF 8] where "4715" is the object number of the room or object. This system permits a navigation and exploration of the MOO itself using the WWW browser.

EdMOO takes a rather different approach at the outset. Here we are concerned with players (teachers) being able to display images, sounds, documents which are relevant to the topic under discussion. EdMOO is not at present treating the WWW interface as a MOO navigational tool. Furthermore, it deliberately avoids automatically providing graphical or sound representations of objects as this might interfere with players' perceptions of the objects they encounter. To explain this, we might consider the coffee shop, which is a space within EdMOO. Adding multimedia functionality could have provided a graphical display of one person's image of this space. At present it is described in text only, and this is the desired behaviour since each player within the coffee shop will use that space in the context of their own interpretation of the text description.

> ..there are booths around the edge of the room, and small, round tables. An impressive espresso machine…[HREF 9]

Drover

The Drover software was developed quickly to experiment with this environment. Initially it was devised as an enhanced telnet program to assist navigation and programming in EdMOO. Once work had begun, it quickly developed into the form where it was able to interface with Netscape at least as far as forcing Netscape to load URLs. The screen picture indicates three groups of control buttons which perform the navigation, and various common MOO functions. Of particular note is the "N" button which causes the page loaded on the player's Netscape to be displayed to all other players in the room. Other buttons perform URL loading in combination with pull-down selection menus.

Most importantly, the objects being played or displayed need not exist on the local server, but may exist anywhere on the Internet as long as the players have access.

The ability to display objects is dependent upon player status and the "room" being used. For example, in three meeting rooms have been built, only registered players may display objects to other players. In EdMOO, rooms are programmed to allow the "showsite" command. Upon reception of the instruction, the Drover program on each player's computer will trigger Netscape to load the URL indicated. Other commands include "whispersite", whereby a player may cause a URL to load secretly on one other player's screen.

EdMOO In Use

The screen display below shows an example of Dover in use with EdMOO. In discussing the community of online quilters, three players were shown the page of "World's Worst Quilt". The image is typical of what an EdMOO player would have seen on their screen during this session. One window shows the telnet dialogue being displayed by the Drover software. The other window is Netscape having loaded the URL under discussion for all players in that room.

The Drover package adds multimedia functionality to EdMOO through its programmed interface with Netscape. Obviously, players using multimedia must have Netscape installed. At this level, EdMOO adds to the communications artifacts which a teacher-player may call upon while interacting with others.

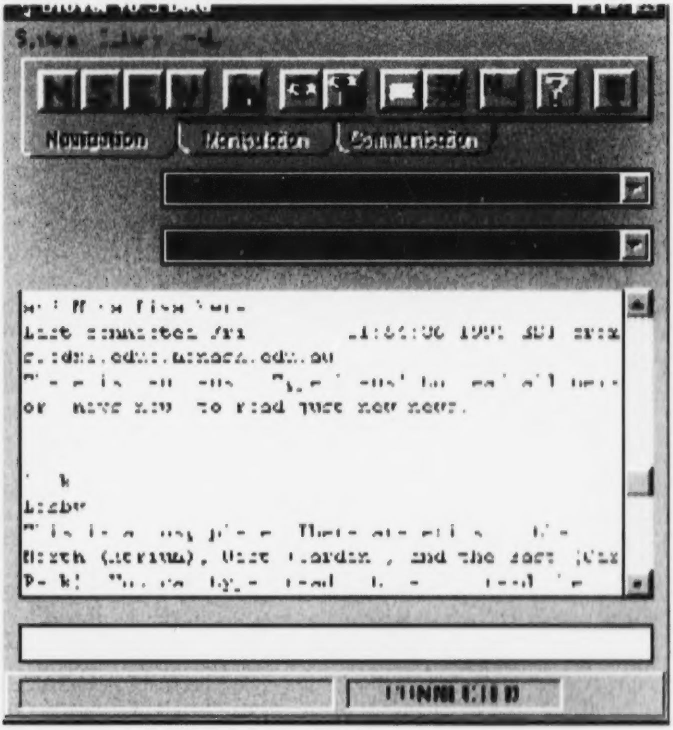

Figure 1: The Drover Software Screen

As with any LambdaMOO, EdMOO permits privileged players to create virtual objects in various spaces or rooms. The environment of EdMOO additionally allows programmed objects to perform URL loads at the player's workstation, or indeed at other players' workstations. As a simple example, in the Lobby, the command "look david" causes the MOO to respond text "It's the famous sculpture.", and simultaneously, Netscape loads a picture of that statue from a distant Web site. At the time of writing, a Jukebox in the Coffee Shop had been programmed to output various entertaining text messages in response to players' instructions. (Grover, Interaction in the Coffee Shop, 1996) [HREF 10]

Kick Jukebox
    The Jukebox lights flicker on
Play Sgt Pepper's
    The sounds of Sgt Pepper's fill the coffee shop

Code may be added to this object that would allow the Drover client to perform any number of Internet functions :

- Display a graphic from the local or a remote site;
- Play a sound file from the local or a remote site;
- Play a movie file from the local or a remote site;
- Download a file from anywhere; and
- Send Email to a specified user.

All of the above functions could be directed to the player who uses the object, to a specified other player, to all other players in the room, or indeed to other players in the MOO. Equally, the

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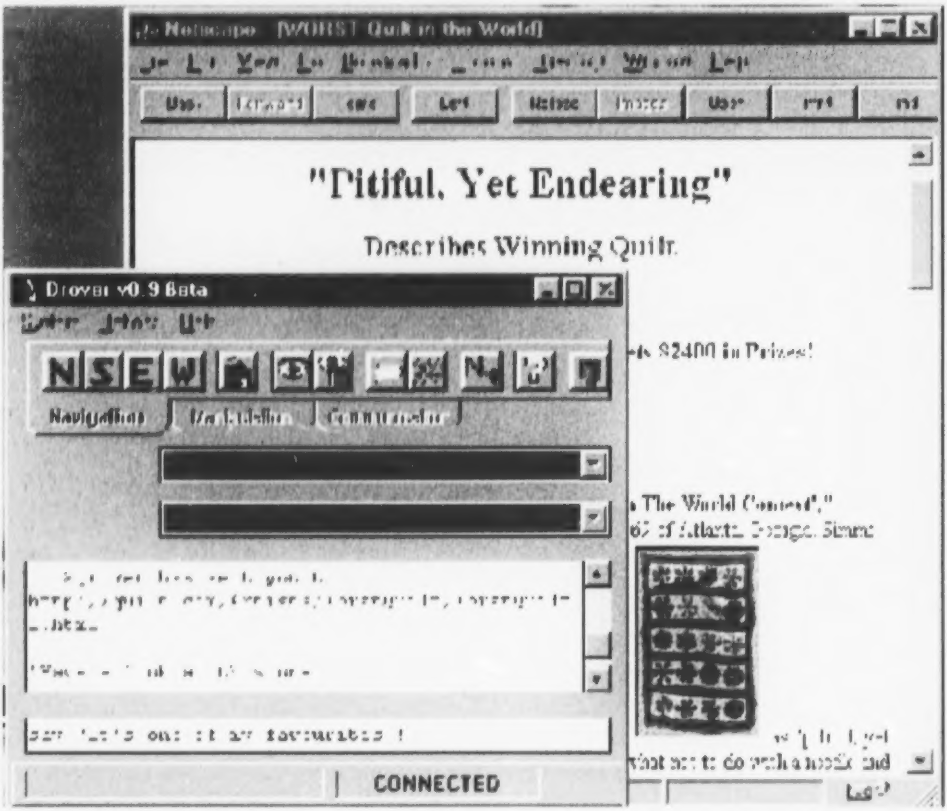
programmed objects could be established that would invoke PERL scripts to create or modify Web pages on various servers. The programmers admit that there are possibilities which they have yet to explore.



"Pitiful, Yet Endearing"

Describes Winning Quilt.

$2400 in Prizes!

The World Contest",

Problems in MOOspace

In building the initial EdMOO environment, some typical MOO problems became evident. Schweller [HREF 11] identifies some of these as follows :

- "Noise" in a crowded room;
- Problems for players being unable or reticent to type in real time; and
- The need for powerful and flexible user tools.

After the addition of the multimedia extensions to EdMOO, these three issues in particular became worse, and techniques to solve them were developed.

In meeting room one, which was envisaged as a conference venue, only one person at a time may display objects. This is designed to keep the noise level manageable, and one person in control of the multimedia displays. The analogy being used is that of the "talking stick". To be able to display a WWW site, document or other item to players in meeting room one, the person must be in possession of the talking stick. This is merely a programmed object which can be passed from player to player as required. Other rooms do not have such restrictions as yet.

Another difficulty which will be addressed is the potential for annoying behaviour of a player. Since the environment permits programmed and interactive control over all of Netscape's functions (at the time of writing), it would be possible for a player to attempt to send files from remote computers to the participating group without invitation. Similarly, players have been frustrated when a discussion involves movement of multimedia files too quickly to view in real time. Future versions of the software and programming modifications to EdMOO will attempt to rectify these difficulties.

Constructing the Player

MOOspace allows the player to "be" anyone they wish to be. EdMOO experience has already shown that players are willing to go online without identifying themselves. Since this MOO has been developed specifically for teachers to collaborate, and for teachers to conduct experiments with these spaces, there is at least potential for players to use the multimedia functions to enhance their constructions of themselves. This might of course result in a MOO population of super teachers, or indeed objects which respond to each other, and change their images as they interact. Much of the documentation process in this research concentrates upon players' constructions and constructions of themselves.

Some of the questions which will be addressed in the research include :

Is it possible to have a virtual meeting which is effective?

The fact that educators can participate in directed discussions from time to time regardless of their physical location suggests that the EdMOO might develop protocols for virtual meetings, and that new roles for meeting coordinators and attendees would arise. There is clear potential for programmed objects to enhance these interactions if the participants regard this as useful.

To what extent do casual interactions serve to assist the professional development of educators?

As a contrast to prearranged meetings, educators' casual use of spaces and objects in EdMOO will be documented to establish amongst other things, whether the formation of small and temporal groups takes place and creates some professional advantage.

Can electronic documents and multimedia objects be organised into useful collections through the collaborative environment of EdMOO?

With the potential for objects or rooms to invoke various Internet activities, such as the displaying of documents, sounds, and graphics, there may be some ways to use the MOO as an intelligent interface for educators to support others.

What aspects of the EdMOO environment show potential for direct instructional assistance?

Although beyond the scope of this paper, there have already been interesting developments in use of EdMOO to experiment with a particular kind of online teaching. This might be an additional indirect outcome for players (teachers) who develop considerable skills or interest.

Future work

Data collection will establish new directions, particularly in the sense of adding programming tools to assist players with their constructions, and possibly also to encourage their constructions. It is possible that navigational elements may be added to EdMOO to assist players in their visualisation of the space, but at the moment, this is not being pursued deliberately. It is believed that a move in this direction might interfere with the players' perceptions of various spaces and objects.. Further work with the Drover software is planned, although it is recognised that the current package has limitations, and should be regarded purely as a prototype.

References

Coppieters, K. *BioMOO's Web Interface*, http://bioinformatics.weizmann.ac.il/BioMOO/BioWeb (12 Jan 1996).

Schweller, K. *Building Tools for Education.* http://tecfa.unige.ch/edu-comp/DUJVRE/vol1/no1/building_tools_for_education.text (8 Jan 1996).

Hypertext References

HREF1
http://edx1.educ.monash.edu.au/projects/moo - The EdMOO home page.
HREF2
http://edx1.educ.monash.edu.au/projects/moo/drover.htm - The home page

for the Drover software.

HREF3

http://tecfa.unige.ch/edu-comp/WWW-VL/eduVR-page.html#Teaching - TECFAMoo

HREF4

http://bioinformatics.weizmann.ac.il/BioMOO - BioMOO

HREF5

http://tecfa.unige.ch/edu-comp/DUJVRE/vol1/no1/building_tools_for_education.text- MOO Tools for Education

HREF6

http://tecfa.unige.ch:4243/about_E_MOO - E_MOO

HREF7

http://bioinformatics.weizmann.ac.il/BioMOO/BioWeb - BioMOO's Web interface

HREF8

http://bioinfo.weizmann.ac.il:8000/99anon/anonview/4715 - A BioMOO object

HREF9

telnet edx2.educ.monash.edu.au 7777 - Description of the EdMOO Coffee Shop

HREF10

Grover. Interaction with the jukebox. Telnet edx2.educ.monash.edu.au 7777 (14 Jan 1996).

HREF11

http://tecfa.unige.ch/edu-comp/DUJVRE/vol1/no1/building_tools_for_education.text - Building tools for Education.

Appropriate Media Versus Multimedia

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The twentieth century is known for its burgeoning development of technology. This development has naturally been mirrored in education. Technology and the mass media have a great impact on all sectors of society. Media and technology have been with us for years and are here to stay. However, in education, educational technology is perceived as a 'gadget' for window dressing, and labelled as a luxury which we can ill-afford and can manage without. At most institutions technology is also relegated to the bottom of the annual budget. Can educators think they can escape technology ? To my mind, it is a matter of adapt or perish.

Several educators are of the opinion that with the absence of high-tech facilities and expensive resources little effective teaching can take place. There are still others who believe that an exposure to a variety of media leads to better learning. The utilization of media should not be over-emphasised or dominated by flashy commercial products. Media should facilitate the teaching-learning process, not hinder it.

Media and Technology

Media and technology have assumed a high-profile in the realms of business, education and home environments. Those of us who work with educational technology have a penchant for innovation, and are expected to implement this new presentation medium in our work environment. When it comes to media, the good thing is that one no longer needs to motivate people to use it. The challenge though is to motivate people to use it effectively and efficiently. Media will not only change the way students learn, but will also change the way educators think about teaching and learning.

It is true that new technologies create new uses. Media and technology brim with creative potential and at the same time with the potential of misuse and abuse. The visible presence of technology in an institution does not necessarily benefit the majority of students and enhance instruction. The mere exposure of media and technology to learners is not enough. There is no guarantee that learning will take place.

Media ought not to be employed as distracters, rewards, mere adjuncts to instruction, for their power and potential in the learning process are invaluable. Their use should be a major factor in the delivery of quality instruction. Effective use of media and technology is a challenge and an opportunity for educators. There is the fundamental law that applies to the application of technology to any operational process : technology does not reduce costs or improve results, people do.

A Shift in Paradigm

An educator is no longer the 'bastion of knowledge' as the role of the instructor has changed, from one of the dispenser of information to that of a facilitator of learning and subsequently assumes the role of a manager in the classroom. Further, there is a clear shift in the educator's role away from the traditional one-way communication' model to a multi-dimensional communication situation.

The traditional educational paradigm presents a situation where educators provide instruction based on their own knowledge and experience. The educator, in this paradigm, is the primary source of information, and controls the order of presentation. Knowledge and information is transmitted and transferred in a linear fashion from the sender to the learner. (Figure 1)

KNOWLEDGE AND INFORMATION
EDUCATOR
CLASS OF STUDENTS

Figure 1 : Traditional Educational Paradigm

The technology-based paradigm provides access to modern storage technologies at a student workstation. Students can now access and manipulate information at a faster rate, removing the limitation imposed on them by the old paradigm. This multidimensional communication model allows the student to interact with the subject material, with other students, with the environment or with multimedia and technology. Technology facilitates information delivery by giving learners a variety of options based on an ongoing assessment of each student's interest, motivation and cognitive ability. By providing direct access to the knowledge-base, the new paradigm challenges students to manage and manipulate vast amounts of information while encouraging them to reflect on their own learning. It enables students to change roles from a passive recipient of information to an active knowledge worker.

Learners receive information and instruction in many modes and from many sources. Due to the tradition of printed materials in education, we have become accustomed to reading in a sequential and linear manner. Information is encountered in a lock-step sequence predetermined. Our thoughts are confined by the limitations of the print media (word) . Cheap paper and printing democratised the knowledge base of society. Today, the limitation can be a deadly one for learning because the huge volume of information will not be effectively accessed by conventional means. The printed word will be for many learning situations, simply too restrictive, bulky and slow. Media is built around the premise that anything words in print can do, words with sounds and pictures can do better.

In addition, to the more common print media (books), audio media (audio cassette), the displayed media (charts) or projected media (slides) ; there are the conventional electronic communication media (television, radio) and computer media (internet, email, CD-ROM), CuSeeMe. Most of the information are stored in electronic format. This range of media poses a problem and a challenge to the wide media skills the educator (and students) has to acquire and master, such as technical knowledge, equipment knowledge, computer literacy and to develop a personal disposition towards the wide range of media available.

Setting of Parameters

Media Selection

The choice of teaching methods and media depends on the learning situation, the learner, subject, the educator and the institution. Media and methods should get attention for their intrinsic characteristics. The teaching of content should take place through the most appropriate medium — be it audio, audiovisual, face to face, tactile media, electronic media, self-study packages etc. and the choice of the medium should be part of the curriculum development planning phase, not added on.

Media selection is a key stage in the instructional processes employed by educators. In an era in which innovations in electronic and other media present a bewildering array of options to the educational practitioner, media selection and the factors that influence selections need to be fully understood if appropriate choices are to be made.

Educational Technology has seen a gradual but significant shift from a behavioral paradigm to a cognitive paradigm and more recently, constructivist perspectives of instructional design. These paradigms have explicit and implicit views of knowledge, the learner and the media. This is clearly demonstrated in the construction of different models of instructional design and more specifically media selection. Media selection models and approaches share the common view of media selection as an important stage in the design of an instructional event. Romiszowski (Figure 2) employs comprehensive flowcharts that take the user through a series of questions designed to aid selection by the rejection of generic groups and variants of media until the final choice is left to a short list of appropriate media.

SUBJECT MATTER
TYPE OF LEARNING TASK
TARGET POPULATION
TEACHER'S ATTITUDES, SKILLS, ETC
MEDIA SELECTION
PHYSICAL CONDITIONS
    SPACE
    LIGHTING,
CHARACTERISTICS OF STUDENTS
    LEARNING STYLES
    SKILLS
PRACTICAL CONSTRAINTS
    MONEY
    TIME
    MATERIALS
METHODS SELECTION

Figure 2 : Factors Influencing Media Selection (Romiszowski, 1988, p. 5V)

The Educator

Good teaching is provided by the educator who is conversant with their subject matter, informed about their students' characteristics, able to impart the subject knowledge to their class in a meaningful, interesting and motivating way, guiding them towards greater understanding of their subject and in general to be better prepared to function as a citizen in the environment. How can an educator become a good teacher ? No doubt by opening up the communication channels, using all available and the most effective pathways to reach students. Some teachers are excellent and are natural exploiters of the verbal communication channel, but most of us are not, and unfortunately, perform indifferently well. This is where the use of media and technology assists us by making our teaching task easier and the learners' experience more rewarding. When dealing with high-tech media the educator's personal disposition towards the media is important. This may involve the ability to change, explore new ways without prejudice, the enthusiasm, to move from one teaching model to another in one's subject, the insight to display innovative thought while maintaining a critical, rational approach to the required learning outcomes, the skill to adopt and develop a personal style that is compatible with certain media and to strive towards optimal learning environment.

No one technology can truly rival an expert educator to giving and receiving information. Edward Murrow once said, "technology itself can teach, but without the human element, technology is like a box of wires..." Educators today have a marked fear of using new media and strategies. The other lame excuse of why bother to set the equipment and borrow the media -if one can manage without them. Having been educated with the textbook, many tend to stay with the familiar, 'tried and tested' approach, following the path of least resistance by adopting the same method as they were taught. Many educators have yet to be convinced of the place of media and technology in education. New skills will be required in consensus building and priority setting in which a proactive style replaces the typical reactive posture. Like any artist, an educator has to acquire expertise through formal training and education, as well as master the skills through practice. Educators need to be knowledgeable and uncompromising in their strive to provide the best for the situation the students find themselves in. If educators have a phobia of a certain medium of instruction, they are unlikely to use it well. The question of attitudes and feelings of staff are among the most important factors affecting the success of any lesson. The educator has to have an open mind towards the use of media. Blatant disregard for important characteristics of the learning situation will inevitably lead to poor course design.

There is the need to fully accept the possibilities and limitations of new technology. Machine gadget is the medium through which a subject is taught and that it cannot accomplish this task on its own. The mere exposure of media to learners is not enough. Starting with media and technology can be time consuming and more often than not, very confusing. But the end result — improved education of the young makes the effort worthwhile and rewarding.

The Cost Factor

Using media is more expensive than the talk and chalk method. This expense has to be weighed against the immediate effectiveness and rapid understanding of the 'content'. The long term cost implications should be calculated to include the cost of production, hardware and software, total hours per day the system can be utilized. The emphasis today is not on any one approach or feedback — but on an integration of a variety of methods and media into an appropriate and effective learning environment catering for the specific needs and diversity of the learners.

Institutions frequently acquire media in a non-systematic fashion. Generally the exact use is not determined prior to the purchase of the hardware. Often media, having been purchased by well meaning PTA's are donated to the institutions. The purpose of media is to simplify instruction. They should not make the process of learning more complex. Media are used, sometimes, without much thought. They are selected on the basis of their availability. Media and technology unless well managed, will reduce rather than increase efficiency.

Ill-suited hardware and/or software are often forced upon and accepted by blissfully ignorant educators. Educators are fond of asking the following questions: Should we buy this or that hardware ? or what software can we do without ? The appropriate questions educators should be asking are : Can we disregard our duty to educate ? Can we in the process afford to ignore any appropriate media that may guide learners to acquire new information and skills ? There is a profound difference between using technology effectively and adding technology to an existing structure.

Media Utilization

One presenter recently remarked, media utilization means more than one trip to the car. The trend of media research so far appears to lead to the conclusion that learning is influenced by the quality of the presentation only to the extent that the quality influences the clarity of the message. For many years the utilization domain was centred around the activities of the educators. Teaching and learning models and theories today focus on the user's perspective. No single media nor technology possesses all the attributes that are ideally needed in an instructional task. The ASSURE model presented in the text by Seels and Richey (1995: 43) has become a widely accepted guide to help educators plan for and implement the use of media in the teaching situation. The steps in this model are

Analysis of learners
State objectives
Select media and materials
Utilize media and materials
Require learner participation
Evaluate and revise

Daniel Kinnaman (Gray: 1994-45) stated, "in the information age, students need to do more than just find the information — they need to know how to separate the fluff from the substance". To enhance learner's achievements, media and technology must be used effectively in the instructional process than ever before. New technologies present the prospects of creating increasingly realistic stimuli, providing for quick access of large quantities of information, rapidly linking information and media, removing the barriers of distance between instructor and learners and among learners themselves. The rich have untold power at their finger tips and through high performance and the manipulation of the communication and computing resources and work with others around the global village. Those who fail to understand and learn the use of communication and computing systems will become underclass totally disadvantaged in an increasingly competitive society.

Conclusion

The visions of learning and teaching in many reform proposals stress : the active involvement of the learner in the learning process; attention to intellectual and emotional skills at many levels; preparation of the young to assume responsibilities in a rapidly changing world and flexibility among students who will enter a world of work that will demand life-long learning. (Kearsley & Lynch, 1994: p159) . Educators and administrators need to be properly prepared to promote and manage technology. In many cases technology is inappropriately or ineffectually used and by the almost complete absence of specific training.

One area that is especially important for educators is the ability to critically evaluate existing and new technology. We need educators who can think about the possible side-effects and human impact of technology and weigh these consequences in the their decision-making. We do not want a generation of technocrats any more than we want 'technophobes'.

References

Criticos, C. 1994. *Media Selection*. In T. Husen & T.N. Poselthwaite (eds) . Second Edition. *The International Encyclopaedia of Education*. London: Pergamon Press. pp3756-3760

Ely, D.P. & B.B. Minor (Eds) . 1993. *Educational Media and Technology Yearbook*. Volume 19. Colorado: Libraries Unlimited

Galbreath, J. 1994. "Multimedia in education: Because its there?" *TechTrends*. 39(6): 17-20

Gray, R.A. 1994. "The school media specialist: Teaching in the information age". *TechTrends*. 39(6) : 45-46

Kearsley, G. & W. Lynch. 1994. *Educational Technology Leadership Perspectives*. New Jersey: Educational Technology Publications.

Kistan, G. 1995. "Expanding frontiers through collaboration and networking". Paper presented at the International AECT Convention. Anaheim. USA. 08-12 Feb, 1995

Romiszowski, A.J. 1988. *The selection and use of instructional media*. Second Edition. New York: Kogan Page

Seels, B.B. & R.C. Richey. 1994. *Instructional Technology: the definition and domains of the field*. Washington, D.C.: Association for Educational Communications and Technology

Factors Affecting Teachers and Trainers in the Use of a Bulletin Board System: A Report

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In order to more accurately assess how mature-age, part-time graduate diploma students in an information technology course coped with the use of a Bulletin Board System (BBS), a survey was conducted towards the end of 1995 of a group of sixty-six students who were enrolled in the course at the time. The aim of the survey was to ascertain the level of student involvement in the use of the BBS, identify students' principal concerns, ascertain learner perceptions and satisfaction as well as establish the need for appropriate resources to ensure more effective integration of technology particularly in the use of electronic communications in future course planning.

Research findings have shown that the use of computer conferencing can enhance and supplement teaching and learning and provide fertile ground for ongoing learning and professional growth (Harasim, 1990; Honey, 1995; O'Gersh, and Posamentier, (1993); Schrum, 1995; Spitzer and Wedding, 1995; Weir, 1992). A number of studies have suggested that the use of this technology will allow both teachers and learners to interact with each other beyond the confines of the classroom (Casey, 1994; Kazuo et al., 1995; Waggoner, 1992). Teachers need to be trained to understand the basic components of telecommunications including understanding of the use of the computer, the functions of a modem, telephone and communications software, develop skills in messaging and conferencing and to become active participants on electronic networks (O'Gersh, and Posamentier, 1993).

Many of the students enrolled in this course lead very hectic lives and time for study is often limited increasingly by other obligations. Their life circumstances often impose constraints on the ability to access services in the traditional manner. Since this graduate diploma has an information technology focus it was felt that students should be encouraged to use electronic means to communicate with lecturers and to perform other related activities. In this way students will be gaining first-hand experience of the medium.

Background

For the past three years, a bulletin board system (BBS) has provided messaging and computer conferencing facilities for the students and staff of the Graduate Diploma in Information and Communication Technology Education course. In one of the units within this course it was compulsory for students to submit their final assignment using the BBS. Students can either connect directly from home or their workplace using a modem or complete the task on-campus using the computer laboratory for access to the BBS. During the semester, assessment tasks were set where students had to upload their findings so that the information would be accessible by other students for analysis and discussion. As one of the choices of their final assessment, students could choose to write an analysis of the information presented on the BBS on a selected topic. This final analysis when submitted would also be made accessible by way of the BBS to the rest of the students in the course.

On average, over the three years there were about 120 students who participated in the use of the BBS. Most of the students were teachers or trainers completing their graduate qualification on a part-time basis. In general they worked full-time during the day and take most of their classes in the evenings, on weekends or during school vacations.

This student cohort represented the range of diverse teaching professionals. These students were commuting to campus and had packed all their courses into one year of full-time or two years of part-time study. This in addition to their life commitments have left them little space to manoeuvre. The BBS was set up to provide a convenient and efficient means for students to interact with faculty and each other.

Since these students were enrolled in an information technology course it was felt that they should explore and explicate a fuller meaning and understanding of using the BBS as a means to enhance learning. It was expected that these students would already possess the necessary technical skills in the use of computers to be able to use the BBS without great difficulty.

Faculty was of the view that being educated in computer information technology is more than an instrumental understanding of how a computer works or is used; it is the development of a broader conceptual framework from which a person is able to understand the issues and implications of the technology. After all these students are teaching professionals and they would ultimately take their experiences back to their own students whom they have to teach when they complete the course.

With this rationale, the BBS facilities were thus set up for students. It was compulsory for students to send electronic mail to the lecturer and to transfer assignment work (upload/download files) through the use of the file transfer utility. Those students with a computer and modem connections were encouraged to connect from home, whilst those without had access to the computer laboratory on campus to perform the same tasks. There was no pressure for the students to purchase a modem as facilities were readily available on campus for those who wished to access them.

Students were given a manual on how to connect to the BBS. The electronic file of the manual was also available on the BBS for students to download and then print. The students were given an induction session on how to use the BBS and was provided with the telephone number for the Systems Operator (SYSOP) in case any problems arose. The role of the sysop (who had undertaken this role over and above his lecturing responsibilities in the course) was to help students overcome difficulties in their early attempts to use this electronic means of communication. This person was able to give students some technical help where appropriate.

Within the student population there was substantial variation in the extent to which students used the BBS. Some students, particularly those comfortable with the use of the computer, tended to be very active. Others used the BBS only in a limited way, i.e. they would submit their work online and not continue to engage in the use of the BBS for conferencing purposes or to send messages to the lecturer concerned.

Methodology

In November, 1995, a questionnaire containing twelve questions was administered to sixty-six students enrolled in the course. It consisted of a combination of multiple choice questions, Likert type questions and open-ended questions.

The specific objectives of the survey were to: (1) establish the level of student involvement in the use of a BBS as part of their course of study; (2) identify technical and structural concerns associated with this medium; and (3) ascertain learner perceptions and satisfaction in the use of such a medium and determine the types of resources required to effectively integrate this technology.

Findings

The major findings were:

1. Higher level of awareness of Bulletin Board Systems. In the three year period (1993 — 1995) a large percentage (85%) of students in this sample claimed to be aware of BBSs as compared to 15 per cent in the years prior to 1993.
2. A large percentage of students owned their own computers. Eighty-three per cent of these students owned a computer, whilst 36 per cent of them also owned a modem. Of the students

who indicated ownership of a modem, seventy per cent of them had high speed modems which were capable of transmitting at speeds of 14400 bps or higher.

3. The main reasons for buying a modem fell into three major categories: (a) to connect to the Internet; (b) to electronically transfer files; and (c) to engage in activities on the BBS.
4. Student self-perception of computing skills at the time of purchasing the modem was fairly low. Twenty-five per cent indicated that they had some skills, with only 15 per cent claiming to be competent users. In contrast when asked what their present level of computing skills were 79 per cent indicated that they either had some skills now, were competent users of computing or were very competent. This is a huge rise in the level of skills perception on the part of the students over a period of three years.
5. Response to the provision of Email facilities was positive. When asked to respond to a series of questions in regard to email facilities, the results are shown below.
   A very high percentage (88%) of the students indicated that they would like to have email facilities whilst doing this course. Fifty-one per cent were prepared to pay between ten and twenty dollars to register for email facilities while thirty-one per cent were prepared to pay twenty-five dollars for such a service. Additionally fifty-seven per cent were prepared to pay between ten to twenty-five dollars for telephone bills to connect to such a service with thirty-five per cent indicating their preparedness to pay fifty dollars or more.
6. Responses to the question "What else would you like to be able to do from home?" are shown in Table 1 below.

Items	%
Internet access	83
Access to library/databases from home	82
Interact with lecturers	77
Send/receive assignments online	76
Access to course information	67
Engage in computer conferencing from home	52
Engage in peer interaction/group work activity	48
Student records access	35

Table 1: (N = 66)

7. Responses to the question: If courses were offered in flexible delivery modes and you did not have a computer and a modem, would you be prepared to:

Items	%
Buy them	55
Lease them	36
Work at a friend's place	4
Go to a study centre with facilities	5

Table 2: (N = 66)

Whilst students indicated the above responses, some ambivalence is evident since thirty-five per cent of those who had selected options as shown above also indicated that they would like to travel to attend conventional classes.

Problems

The items requiring qualitative responses were analysed and summarised to produce qualitative themes as described and discussed below. The most frequent criticism about the program noted by students was that not enough time was given for familiarisation with the medium. Technical concerns remain the main issue for a large number of students. When asked to reflect on their initial experience of using the BBS, students recalled:

- having spent numerous hours fiddling with the equipment trying to connect;
- lack of guidance from anyone;
- confusion and lack of knowledge on what to do;
- absence of clear course notes to facilitate BBS connection;
- having to resort to external help and support e.g. PC Users' group, friends, colleagues, computer magazines and
- experiencing great difficulty connecting to the BBS from external locations lines dropping off all the time.

Student perceptions

In regard to the question which requested students to provide further comment on whether provision of electronic facilities is useful or necessary, the main theme appears to be that students should be given a choice of selecting the modes of study which they prefer. On the whole there is a very positive response to the use of electronic communications or computer mediated delivery of courses provided that a high level of support is available to alleviate problems such as inadequacies of software and the system's ease of use. Although students generally agreed that the use of the BBS seemed to emerge as a medium — that if integrated well into the course — can contribute significantly to a better, more student-centred learning climate, their frequent comments indicated high levels of frustration in relation to the technical and structural problems encountered.

Respondents suggested various ways to overcome problems reported above. Specific solutions included: better technical support — online help; clear instructions to guide students through installation of modems and how to connect to the BBS; several hands-on workshops for familiarisation with the medium before students have to do it on their own; standardisation of equipment i.e. faculty to recommend certain brands of modems and communications software with clear instructions for installation; and ensure that downtime was minimal. Students felt that unless these problems are alleviated, the conceptual advantages the medium has to offer will not eventuate.

Conclusions and Implications

This report has encapsulated the excitement, positive perceptions of the value of electronic communications and student's willingness to pay for such services. At the same time though student comments reveal fairly high levels of frustration that have accompanied early attempts at making effective use of the BBS. Students realised the benefits of the ability to use electronic communications as it allows them to become actively engaged in a community of people sharing and creating information. These students were excited by the fact that they can draw on new kinds of resources to experience new kinds of learning opportunities, and to work flexibly with materials in shaping educational experiences fitted to their needs. Since it was compulsory within this course that students had to use the BBS, students really did not have a choice in whether to use this technology or not. However, despite the frustrating experience, most of them managed to cope and with the exception of a minority of students, and most are now ready to use email and the Internet.

Responses to questions as indicated above reveal that a taste of this new technology has led students to demand much higher levels of access and more sophisticated use of the technology. Essentially all participating students are of the opinion that the provision for telecommunication on this campus is essential and should be implemented as soon as possible. A fundamental question, however, about the use of electronic communications still needs to be asked — how much value will be realised in practice due to its availability in educational settings. Will these students transfer their skills into their own future classrooms when they complete this course? From the positive responses obtained in this survey there is a strong indication that these students who have had some experience of the BBS will now be better placed to join the electronic communities on the Internet thus forming networks of their own to share their thoughts and ideas and to see this as a continual challenge. What is clear from this survey is that for technology to be integrated properly into the course, students must use this medium in more then one subject within the course. Using the technology in isolation will not prepare these students adequately. More opportunities must be available for students to develop their competence in this area so they can effectively model and demonstrate its use in their own professional activities.

References

Casey, J.M. (1994) TeacherNet: Student teachers travel the Information Highway, *Journal of Computing in Teacher Education,* vol 11(1), 8–11.

Harasim, L.M. (ed.) (1990), Online Education: an environment for collaboration and intellectual amplification. In *Online Education: Perspectives on a New Environment*, pp. 39–64, Praeger Press, New York.

Honey, M., Tally, B. & McMillan, K. (1995) Online Communities, *Electronic Learning,* January.

Kazuo, W. Hamalainen, M. and Whinston, A.B. (1995) An Internet based Collaborative Distance Learning system: CODILESS, *Computers and Education,* vol 24(3), pp. 141–156

O'Gersh, S. and Posamentier, A.S. (1993), "Using Telecommunications to Enhance Educational Experiences". In Payne, C. (eds.), *Education in the Age of Information: The Challenge of Technology, Fulbright Papers (12),* Manchester University Press, Manchester, 81–94.

Schrum, L. (1995) Educators and the Internet: a case study of professional development, *Computers and Education,* vol 24(3), pp. 221–228.

Spitzer, W. and Wedding, K. (1995) Labnet: An Intentional Electronic Community for Professional Development, *Computers and Education*, vol. 24(3), 247–255.

Waggoner, M. (1992) *Planning for the use of computer conferencing in collaborative learning.* In D. Carey, R. Carey, D. Willis and J. Willis (Eds.), *Technology and teacher education annual 1992.* Greenville, NC: Society for Technology and Teacher Education, 556–561.

Weir, S. (1992) Electronic Communities of learners: fact or fiction? In Tinker, R.F. and Kapisovsky P.M. (eds.) *Propects for Educational Telecomputing: Selected Readings,* 87–110, TERC, Cambridge Mass.

Determining the scope of online delivery at a traditional research-based university

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In determining the scope of online delivery of programs currently being developed within the Faculty of Education at The University of Melbourne a number of factors have been involved. Initially, for teachers wishing to participate in professional development programs this was seen as a simple matter of combining targeted web-based resources with electronic discussion lists. However, the picture became somewhat more complex when the Faculty decided to embark on developing online delivery of its existing teaching programs. The discussion is first contextualised by an historical description of the development of information technology (IT) at the university. It further endeavours to make explicit that the short 'half-life' of technology itself is a key determinant of the implementation pathways chosen.

It has been a concern for a number of years now that the integration of IT into the school curriculum be led by sound pedagogical principles and not by the technology itself. But this is much easier to talk about than implement in this age of technology-driven cultural change. The 'half-life' of technology, particularly IT, demands that we consider accessing a vast range of telecommunications, computing, and entertainment products and services and participate in the wider 'global community', or be left behind. For many academics in higher education, despite the ready accessibility of resources, this can be a threatening (and frustrating) experience; for many teachers of K-12 where the resources just sometimes do not exist, it can be overwhelming.

In an attempt to alleviate this situation, involving teachers as the main target group of a Faculty of Education professional development programme, an added pressure complicates the picture: politics. The policies of governments and the promises of political parties at election time create expectations which can hide the enormity of the tasks required. Such policies and promises are not necessarily negative, and in the current Australian situation can be seen as a positive force for educational reform—because the rhetoric surrounding initiatives such as EdNA (Education Network Australia) capture to some degree the urgency for educators to seize new technological tools or be enslaved by them. In the case of The University of Melbourne's strategic adoption of IT, within the context of a strong tradition of scholarship and research, it would not be unfair to say that the initial forces of change were largely driven by the technology.

Some history

Until recently, the traditional research focus at the University of Melbourne translated into little or scattered interest in developing programs for delivery by distance mode—this has been left to the newer universities such as Deakin (in Victoria) and Southern Cross (in New South Wales). However, in 1989 the University began implementing a far-reaching Information Technology Strategic Plan which has resulted in all academic and most general staff members now having a personal desktop computer (either Macintosh or PC-compatible) in their offices, numerous new laboratory facilities for student access at a ratio of one computer per 10 students, university-wide and faculty-based multimedia research and development facilities, a comprehensive fibre-optic network infrastructure, and a Campus Wide Information System (CWIS) which has been in place for nearly two years.

When the Australian Vice-Chancellors launched AARNet (the Australian Academic & Research Network) in 1989, The University of Melbourne was charged with managing the international gateway for AARNet. This was Australia's connection to the world-wide Internet. In 1995, due partly to the impending de-regulation of telecommunications in Australia the management of AARNet was taken over by Telstra Internet thereby guaranteeing a greater level of reliability and facilitating commercial opportunities. Telstra Internet will provide bandwidth of 32 Megabits per second (Mbps) to the USA by the end of the year.

By early May 1996 the Victorian Regional Network (VRN) was operational, again with The University of Melbourne as its main hub, providing high speed links between all Victorian universities. There is a high speed connection between the VRN and Telstra Internet.

Concurrent to these developments a number of key Government initiatives have been implemented, the most significant being EdNA which is concerned with facilitating online connections between all Australian educational institutions—schools, universities, TAFE's, and affiliated organisations. Alongside these technological and political developments an academic watershed has also recently emerged: first with the enthusiastic and widespread research and development of multimedia (and 'flexible delivery') in teaching and learning across the university and, more recently, where there is now serious academic attention being focused on the scope of online education relevant to the specialisations of the University.

It is very clear that there is now an incredibly fertile ground at the University from which to cultivate new programs concerned with online delivery. Recognition of this is echoed in a feature article of the Autumn 1996 edition of The University of Melbourne Gazette titled, '*The Virtual University?*', by Professor Alan Gilbert, the new Vice-Chancellor. In it, he says:

> Of course existing universities must assimilate the new communications technologies, and with the utmost effectiveness seek to use the enormous benefits that the 'digital revolution' promises for the advancement of teaching, learning, research and communications generally. This must be an uncompromising, high priority commitment. Otherwise the traditional university will indeed be threatened with redundancy. (Gilbert, 1996: p.5)

These comments are of course qualified. Even though "traditional lectures and classrooms may disappear", he emphasises that it is unlikely that 'cyberspace' will replace the existing rich intellectual, social & cultural life that traditional universities offer—and is better understood as an *extension* of the teaching and learning environment.

Case-study

In 1995 a professional development program for teachers titled, *Computer Literacy for the 90s*, was developed within the Faculty of Education. It was designed to provide participants with an overview of current and emerging computer technologies and was geared toward combating technophobia in teachers (one of the symptoms of technology's short half-life). It combined hands-on experience with assembling/disassembling hardware and a broad range of software applications from wordprocessing to web browsers. It was also designed in recognition of significant developments in what can be understood as the requirements of 'basic computer literacy'—the convergence of technologies underlying computing, telecommunications and television broadcasting being the forces of change behind this. The first year of this program proved very successful and it has continued during 1996. As expected, it undergoes constant development. The attempt to integrate online interaction into this course was initially viewed by the team of trainers involved as requiring a listserver solution. An electronic discussion list that dealt with issues raised during the course was considered to be an follow-up but a number of obstacles emerged in putting this into place: probably the most significant of these being that literally only a handful of participants had access to email! Because of such basic realities, the online components of this course occur in the traditional face-to-face classroom.

In early 1996, partly in response to the success of this program but also due to the pressures of initiatives such as EdNA, the University launched the Technology in Schools Program (http://www.unimelb.edu.au/tisp/). It is partly concerned with providing the appropriate network support, provision of other information services, and access to University facilities. With the well-developed CWIS and IT resources at the University a clear path could be identified for this kind of extension service. Initially, it seemed that the best way to proceed was to tailor access to information resources, such as local multimedia database indexes, directly to the needs of schools (teachers and students) through electronic publication on the World Wide Web. Despite the extensive nature of these resources it must also be acknowledged that for many schools IT facilities are minimal: often there is only one computer with an Internet connection and the connection itself is not capable of much beyond basic text processing. Furthermore, because the nature of activity on the Web (as it exists today) does not necessarily *involve* users in communication or interaction but is simply used as a vast electronic library of interlinked directories, it was decided that complementing these resources with a number of listservers dedicated to certain subject areas would be a good strategy. While listserver technology is nothing new it is a proven method of providing up-to-date information to a network of subscribers as well as providing the mechanism of the virtual forum for ongoing discussion. At this stage, four such lists have been established: Unimelb-TISP (for general news dissemination and discussion); Unimelb-TT (a technical tips digest); Unimelb-Horizons (catering for needs of gifted secondary students); and, Unimelb-Navigator (discussion forum for Project Officers and Principals of Navigator Schools).

Discussion

This leads us to another critical factor in determining the scope of online delivery to be implemented at this University. The new technologies provide new opportunities for teaching and learning in ways that have yet to be rigorously (or at least, extensively) explored and researched. It is likely that new pedagogical paradigms will emerge. We've all been exposed to the hype of this associated with the arrival of multimedia onto the education and entertainment markets. Back in 1991, John Sculley, then CEO of Apple Computer, Inc. was claiming that:

> What tomorrow's student will need is not just mastery of subject matter, but mastery of *learning* (Sculley, J. quoted in Kling and Dunlop, 1991: p. 57)

His successor, Michael Spindler, developed the theme:

> by the end of this decade, approximately 90 to 95 per cent of all existing *knowledge* could be digitised, compressed, packaged, shipped to some place, decompressed and examined. Vast amounts of information could be made available in more compelling form to more people around the world. (The Australian, 1/6/93 p.16)

Providing academic leadership and support to this type of commentary, Hermann Maurer has said of hypermedia:

> … the advent of computer supported multi-media systems provides not just an acute alternative to present information but an enrichment of our sensory and communicative possibilities that will impact society in a major way. … the merging of large wide-spread hypertext systems with computer supported multi-media technology into powerful hypermedia systems will indeed provide a new kind of infrastructure for working, communicating, and thinking whose influence on how mankind will live, work, teach, and learn could be quite dazzling. (Maurer, 1992: p. 1)

More recently, Linda Harasim et. al. (1995), have commented:

> Profound changes at all levels of society and technology demand new educational responses. The paradigm for education in the twenty-first century that is emerging is network learning. Based on global interactivity, collaborative learning, and lifelong access to educational activities and resources, it provides an approach that

> emphasises international connectivities and engenders new ways of working, studying, and problem solving. (Harasim, Hiltz, Teles, & Turoff, 1995: p. 278)

Echoing this, Timothy Luke (1996) recently commented on 'cyberschooling':

> deciding to construct cyberschooling systems will necessitate major changes in our professional practices as educators as well as in the political economies of each university as a public enterprise…the virtualization of instruction shifts us into entirely new registers of action. Much of what we do is rooted to tacit understandings grounded in print culture, industrial training, hierarchic structure, and guild values which run at cross purposes with netcentric modes of operation. Consequently, many existing professional practices may not stand up in this new teaching/learning environment. (Luke, 1996: pp. 17-18)

Luke raises many important questions for anyone considering utilising cyberspace as a teaching and learning environment. His most recent conclusion, borne from experience in implementing a cyberschool at Virginia Polytechnic and State University over the past few years, is:

> the key educational issue for cyberschooling arguably will be how it actually valorizes instruction on such virtual campuses. Will it lower or raise the value of the education being provided? (Luke, 1996: p. 23)
>
> if cyberschools are to be built, then they should be designed by their users as an open-ended experiment to change (but not increase) faculty workloads, enhance (but not decrease) student interactions, equalize (but not shortchange) the resources, prestige, and value of all disciplines, balance (and not overemphasize) the transmittal of certain skills, concentrate (and not scatter) the investment of institutional resources, and strengthen (and not reduce) the value of all academic services. (Luke, 1996: p. 26)

Clearly, there are many issues to be discussed and discussions are only just beginning. It is critical that serious academic research and debate continues to gather momentum and tempers the mainstream media journalism which either "demonises" or "glorifies" the technology. (McWilliam & Palmer, 1995: p. 33)

Conclusions

At this early stage of investigation there are a number of key factors which can be seen as facilitating the implementation of online delivery of teaching programs at The University of Melbourne. These are:

- the existence of a significant number of local 'champions' or enthusiasts
- the well-developed IT infrastructure at the University;
- support from senior academics and policy makers, which translates into providing adequate resourcing. It is now well-recognised at the University that investment into 'the technology' must be matched by adequate and appropriate human resourcing for any ongoing 'critical mass' momentum;
- the adoption of a strategic approach in planning (setting achievable goals and targets; prototyping, so that 'courseware' is structurally optimised for online delivery). Initially, this has been assisted by concentrating efforts on professional development short-courses;
- the promotion of a 'collegiate culture' by the new Vice-Chancellor—because a team approach (between content builders, technical specialists, and administrators of new programs) is required for the range of tasks necessary; and,
- Federal and State government initiatives (such as EdNA and *Schools of the Future*), which have contributed to promoting wide discourse on this and related subjects.

Further (online) resources for investigation

EdNA — Education Network Australia

http://www.edna.edu.au/

Online-Ed — A weekly digest of information relevant to online education, The University of Melbourne

http://www.edfac.unimelb.edu.au/online-ed/

Realigning Your Organization to Learning in the Information Age -The University of Edinburgh, Scotland, July 27-30th, 1996

http://sunsite.unc.edu/horizon/conferences/Edinburgh.html

Teleteaching 96, IFIP — Canberra, September 2-6th, 1996

http://www.acs.org.au/teleCFP.html

Universities of the 21st Century: Education in a borderless world — Singapore, August 13-14th, 1996

http://www.britcoun.org/eissem1.html

References:

Gilbert, A. (1996). 'The Virtual University?', *Gazette*, Autumn 1996 p.5

Harasim, L., Hiltz, S., Teles, L. & Turoff, M. (1995). *Learning Networks: a Field Guide to Teaching and Learning Online* MIT Press, Cambridge, MA

Kling, R. & Dunlop, C. (1991). *Computerization and Controversy — Value conflicts and Social Choices* San Diego: Academic Press

Luke, T. (1996). 'The Practices of Cyberschooling: Some Thoughts on "Instructional Technology" and the Suitability of Cyberspace as an Educational Environment', The University of Melbourne, March 18

http://www.edfac.unimelb.edu.au/online-ed/papers/luke.html

Luke, T. (1994). 'Going Beyond the Conventions of Credit-for-Contact: A Preliminary Proposal to Design a "Cyberschool" for VPI&SU', Dept of Political Science, Virginia Polytechnic Institute & State University, Blacksburg, VA

Maurer, H. (1992). *Why Hypermedia Systems are Important* IIG Report: Graz, Proceedings from 6th HCI Conference

McWilliam, E. & Palmer, P. (1995). 'Teaching tech(no)bodies: open learning and postgraduate pedagogy', *The Australian Universities' Review*, Vol. 38, No. 2 pp. 32-34

Tiffin, J. & Rajasingham, L. (1995). *In Search of the Virtual Class* Routledge, London

A Combined Video and CAL Package on Advanced Level Library Skills for Open Learning Students

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Advanced level keyword and subject searching of library catalogues and CD-ROMs is a skill that requires an effective strategic approach. The need to evaluate the outcome at every step, and to restructure the search strategy as a result of the evaluation of each step, means that the searcher must be able to think flexibly and to apply knowledge and experience to the task of searching. This task can be daunting to the novice, or even moderately experienced, searcher. In this project, video and computer assisted learning (CAL) materials were developed that would model the search process, and provide experience to the learner in the process of analysis, evaluation and reconceptualisation that are critical to effective searching, and provide practical experience of the types of outcomes that may result from keyword searching.

Context

The Open Learning Library Information Service (OLLIS) identified a need for education in library use for Open Learning students. This needed to be a comprehensive skill development program ranging from basic library skills to sophisticated keyword searches of library catalogues and CD-ROM indexes. Another important need was that the program had to be generic. User education classes are carried out in universities to familiarise their students with their own library. Open Learning students, however, have no 'home' institution so that instruction in library use has to apply to any university library.

The University of Southern Queensland was commissioned to develop a combined video and computer assisted learning (CAL) package to introduce students to library use. This was carried out by staff in the Distance Education Centre (DEC) and Library, to introduce students to library use. The package has been developed in two stages, a basic skills package and an advanced package. The introductory package, dealing with title and author searches, and the videotape component of the second package, has been completed and distributed to University libraries throughout Australia. The Advanced CAL program is undergoing the final stage of development (April 1996) and will be available in libraries this year.

Instructional design

Both stage 1 and stage 2 were developed by an instructional designer working with three librarians and a project officer as a close team. All key decisions were made in consultation with the whole team, and all outlines and scripts were reviewed by all members. The close-knit team was an important element in the design and development of the project.

Analysis

The desired outcome of the project materials is that a learner can flexibly carry out any type of search, either for specific items or information on a topic, on any catalogue or CD-ROM index. During the

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content analysis, needs analysis, outline and development of an instructional strategy phases of the project a number of key elements of instructional design and strategy became apparent. These elements underpinned the design and development of the video and the CAL.

(1) Information theory

The need for the materials to be generic, rather than being anchored in any single catalogue system, led to the conclusion that the knowledge base needed by the learners is not how to use a catalogue or CD-ROM index, but information theory, *i.e.* the learner needs to know how to analyse information needs, identify the important information, and assess the potential relevance of information to a task. By focusing on this approach, the learners will be better able to understand what they are doing when they are searching a catalogue or CD-ROM. This led to an instructional approach in which catalogue or CD-ROM searching was preceded by a topic analysis, so that the learner has in mind the type of information needed, and not simply a procedure of using a particular catalogue system.

(2) Level of performance

A large number of key learning points were determined before the project began, however these did not all have the same level of importance. In a consideration of the relative value of specific areas of knowledge and skill a simplified version of Merrill's (1983) Performance Classification System was applied. The original classification rates required performance according to whether the learner needs to remember the information, or be able to apply it, or be able to find the information when it is not provided. Merrill also classifies material according to its nature; either facts, concepts, rules or principles. To carry out the initial analysis, learning points were classified according to whether the learner needed to know about the material (remember) or to do the task (apply the knowledge). 'Know about' or 'do' became a simple classification that had profound implications, as all concepts at the 'do' level are taught comprehensively, with hands on practice. This became the key determinant for the content of the CAL program.

(3) Expert analysis

The task of analysing topics to determine an information need, and searching a variety of catalogues or CD-ROM indexes to find sources of information is carried out regularly by expert librarians. In order to teach novice users to carry out this task, the performance of the experts was subjected to analysis, to determine the generic strategies that are used to find information. This was compared with the performance of novices, which outlined typical problems and set the parameters for an instructional strategy. This analysis involves cognitive modelling of expert performance (Taylor 1994) to determine cognitive processes and steps that may have become automatic and may no longer be apparent to the expert in the normal performance of the task. Having a team of librarians working with an instructional designer enabled the performance to be examined from different perspectives, which enabled all of the steps in the process, and the critical decision points, to be identified and a truly generic strategy to be developed (McAlpine, 1995). This process formed the basis of the instructional content.

(4) Knowledge type

An important issue in the development of this project is the type of knowledge and skill the learner requires. Knowledge and skill are typically considered to have certain elements of factual knowledge and component skills, described by Tennyson (1992) as declarative knowledge (knowing what), procedural knowledge (knowing how) and contextual knowledge (knowing why, when and where). This basic knowledge is overlaid by the application of strategies for management of information and problem solving. These strategies can be general executive type strategies, or strategies for dealing with domain specific tasks (Alexander & Judy 1988, Taylor 1994). Essentially, the skill to be learned in this project is the ability to operate at a strategic level within a knowledge domain (information analysis and searching). While the students need some declarative and procedural knowledge, this is minimal as the task of searching is not procedural. Procedural tasks are considered to become automatic with practice (Clark 1992), however the task of information searching cannot become automatic as the search may be reconceptualised many times according to the outcome at each stage. Using a catalogue or CD-ROM may become automatic, but not shaping a complex search for relevant information. This task does not usually follow any kind of algorithmic process. Instead, the results of each stage in a search must be compared with the individual user's own concept of need, to determine, on an individual basis, in which direction the search must go. This task is inherently strategic. The challenge for these instructional materials was to develop the learners' awareness and competence to operate at a strategic level, with a minimal declarative and procedural knowledge base.

(5) Situated learning

One of the ongoing debates in teaching and learning is the extent to which instruction can take place in an abstract way, as opposed to learning in the real situation, or conditions as close to the real situation as possible. From the theoretical and practical position of the learner learning and 'expert' strategy to the greatest extent possible, it was seen to be desirable to situate the learning process in as real a context as possible to enable the learner to see and practice performance on task from the beginning. Hannafin (1992) presents this approach as a way of ensuring that instruction is not decontextualised, while Taylor (1994, p8) argues that: "The extent to which direct experience of tangible reality is necessary for the generation of an expert knowledge base is a key consideration in the design of instruction." A strong element of the instructional approach used in these instructional materials is to place every aspect of instruction within the context of a particular search, beginning with analysis of the information need, and following this through the search strategy. Using this approach, all instructional points are situated in a simulation of an authentic environment, with a minimum of abstract theory. This was a definitive consideration in the design of the instructional materials and the operation of the CAL program.

Development: Introductory level

The first stage of the project, 'Introducing Library Searching', concentrates on strategies for finding references that are known to the student, such as those provided on a reading list. As the desired outcome is to be able to find references on any catalogue, several catalogue systems are used as models on which the strategies are demonstrated, and on which the student can try out the strategies under guided conditions. The video covers all content knowledge required, beginning with how to select the right library, as Open Learning students may not necessarily begin by using a university library. Students are, of course, recommended to use a university library for all but short assignments. Students are shown how to analyse topics to select the most relevant references, and how to use catalogues for author and title searches. They are also shown how to consult librarians if their initial attempts at searching are not successful, and something of the range of other resources, such as reference collections and being able to consult the catalogue of another library to see if something is held there.

The first stage CAL program provides hands on practice of all skills that the learner must be able to carry out. These include topic analysis, selecting the appropriate references, and searching a range of catalogues for items by title and author. An aspect of the instructional approach is that the user is asked to perform the actions involved in the actual process, rather than answering questions. Thus a topic analysis asks the user to select the key words and phrases, and to select appropriate items involves pointing to the items on a list. Catalogue use is taught by demonstrating a system then asking the user to practice a search on the same system. The process is repeated on another system. As the desirable outcome is that the user can use an unfamiliar system, users are given examples of systems not previously encountered in the program to practice on. Guided feedback is given so that the learner cannot go far wrong in any practice search activity. By a process of emulation of the actual activities involved — selecting appropriate concepts and references and using catalogues — the learner is encouraged to think through and experience the process of information searching at the introductory level.

The strategic focus is on selecting appropriate references and adapting to different catalogue systems. Users learn the conditions under which they should search by author, by title or by subject, and therefore know the type of search they need to undertake. When confronted by different systems, the strategy they learn is to identify crucial instructions, or how to find instructions when these are not apparent on the screen. Menu systems are slightly more user friendly than command systems, however users must learn to cope with both, and to find the commands to use. Practice is given on different systems so that the underlying principles can be understood. In this way, a new and unfamiliar system does not present an insurmountable obstacle. Preliminary evaluation data indicates that users can successfully search a previously unencountered library catalogue system after working through the program.

Development: Advanced level

This part of the project, 'Advanced Library Searching', deals with searching for information in situations where there is no reading or reference list provided, so that the student must search for unknown references on a topic. For this process the student needs to construct keyword and subject searches using catalogues and CD-ROM indexes. The emphasis on learning a strategic approach is even more critical in this stage as searches do not, in reality, lead to a single answer by finding a specific reference. Rather, different individuals searching on the same topic may find different outcomes, all of which may be effective in meeting the interests and needs of the individual searcher. Users need to learn that there is no single correct answer, and that flexibility, a range of strategies, and appropriate evaluation of outcomes to meet the student's own individual interest and need is the way to go when keyword searching.

The need for the users to learn flexibility led to a different approach to instruction. Instead of the users finally having to find references on an unfamiliar system, the users finally experience an extensive search for material, starting with a catalogue, and extending the same search on to a CD-ROM index. This is developed in a case study, in which the user can follow two hypothetical students, each searching for material on the same topic in a different library, and each finding different material that still meets their own need for materials on the topic.

Before reaching this point, users need to learn a range of strategies for dealing with the complex topic of keyword searching. These begin with advanced methods of topic analysis to identify suitable searchable keywords, natural combinations of keywords, and ways of identifying other words that may be used in combination, including synonyms or words that are related to the topic but are not part of the assignment. Selecting suitable words is taught at the beginning, however it is also through the experience of seeing these words used in searches that the user will learn to identify the topic words that are most likely to be suitable as keywords.

The same strategies users learn to find instructions for author and title search are used to find those for keyword and subject searches. This is only briefly dealt with, as the user should be more experienced by the time this program is undertaken. The key point that the user needs to learn is how to evaluate the outcome of a search. Are there too many references, or too few? Are these sufficiently up to date for the topic, and are they relevant to the assignment question? By dealing with these questions users are taught to assess outcomes, and to adjust their strategy as a result of this assessment. This is an important part of the process by which users are taught the think strategically about information, rather than simply finding a reference on a topic. A keyword search will usually find references, however these are not necessarily relevant to a particular assignment.

A keyword search needs to be continually adapted until a satisfactory outcome is attained. In accordance with their assessment of the outcome of a search, users learn to adapt their approach by either widening the search to encompass more items, or narrowing the search to find fewer, and more relevant items. The same approach is applied to CD-ROM indexes. Users are taught the different applications for words such as 'and' or 'or' and use of symbols such as the hash (#) to specify searches, however the strategy for keyword search, evaluation and subsequent modification is the same whether a catalogue or CD-ROM index is used.

Summary

Key elements of the analysis of instructional need are applied as fundamentals in the instructional methodology used in the project. By focusing on the search for information, as opposed to simply using a catalogue, the students learn to assess their needs. The use of the Merrill (1983) performance classification defined the content of the CAL programs, as both the introductory and the advanced program teach skills that the learner must be able to carry out in practice. The use of situated learning as a key teaching element led to the practice of teaching all skills under conditions that are as close as possible to the actual situation in which the learner needs to apply the skills. The identification of strategic thinking as the level at which an expert must function led to great emphasis being placed on learning strategies in preference to factual or procedural information. From these it is hoped that the learner will be able to use a systematic and strategic approach to the complex task of locating information in libraries.

The project team

Instructional Design	**USQ Librarians**	**Programmers**	**OLLIS Librarians**
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	Garry Hall	David Grant	Stephanie Cohen
	Jennifer Redding	Thea Russell	Debbie Leatham

References

Alexander, P.A. & Judy, J.E. (1988). The Interaction of Domain-Specific and Strategic Knowledge in Academic Performance. *Review of Educational Research,* Vol 58, No 4, pp375-404.

Clark, R.E. (1992). How the Cognitive Sciences are Shaping the Profession. In H.D. Stolovitch and E.D. Keeps (eds) *Handbook of Human Performance Technology*, Jossey-Bass, San Francisco.

Hannafin, M.J. (1994). Emerging Technologies, ISD, and learning Environments: Critical Perspectives. *ETR&D*, Vol 40, No 1 pp49-63.

McAlpine, I (1995) Developing a Generic Library Skills Multimedia Package Using and Expert Strategy for Instruction. J. M. Pearce & A Ellis (eds) *Learning with Technology: ASCILITE '95 Conference Proceedings,* The Science Multimedia Teaching Unit, University of Melbourne.

Merrill, M.D. (1983). Component Display Theory. In C. M. Reigeluth (Ed) *Instructional Design Theories and Models: An Overview of Their Current Status.* Lawrence Erlbaum Associates, Hillsdale, New Jersey.

Taylor, J.C. (1994). Novex Analysis: A Cognitive Science Approach to Instructional Design. *Educational Technology* May-June. pp5-13

Tennyson, R.D. (1992) An Educational Learning Theory for Instructional Design. *Educational Technology* January, pp36-41.

A Qualitative Study of Learning from CAL Programs in Two Tertiary Education Courses

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Within the range of current investigations into the effectiveness of education and student learning, a wide range of measures have been developed to assess the effectiveness of student learning and other educational outcomes. These measures include data from case studies, student interviews, large scale surveys of student approaches to tertiary education, and cognitive studies of learning style and memory which, together with attainment tests, provide a comprehensive picture of the motivational, attitudinal and cognitive approaches taken by students, and the subsequent achievement in terms of performance.

When the use of CAL and multimedia is considered, the focus of studies of student learning seems to be much narrower. Many of the studies of learning from CAL use a test of attainment at the end of the program as being the only measure of student learning. This raises questions about the nature of such testing, or of the actual test itself: is it primarily a test of recall or does it test the ability to reason; is there a variety of question styles; do the students have to apply their learning to previously unencountered situations; and what is the significance of the learning task to the learner? These questions relate to the effectiveness of the learning task in terms of its value to the student and, while they have wider implications than can be addressed by individual studies, they represent qualitative aspects that have educational significance, but are generally ignored in studies of CAL.

The purpose of this paper is to consider a range of qualitative aspects and measures of student learning in current use, and to consider the insights into student learning that these provide. This will be considered in relation to the measures used to gauge student learning from CAL packages. An approach to CAL that uses qualitative measures appears to be lacking from the research literature. One such approach, carried out by the author, is described. In this study a measure of depth of processing, the Structure of Observed Learning Outcomes (SOLO) taxonomy developed by Biggs & Collis (1982) was applied.

Qualitative measures of learning

Qualitative measures of learning are aimed at informing us about aspects of learning that do not emerge from conventional test scores. Aspects, such as the learning style employed by the student, the students' perception of the nature and importance of the task and the approach taken, or strategy used to achieve learning, and the learning outcome in terms of its meaningfulness to the student or depth of learning are all important issues in relation to the overall educational aspect of the learning task. The level of student attainment is clearly related to the way in which students approach their studies. This approach can be considered as a style or a strategy for learning, with more effective strategies clearly leading to a greater level of success. An understanding of the learning strategies used by students can provide some guidance as to the way that learning tasks are best structured to bring about the desired outcome.

To identify approaches to learning, Biggs (1987), Schmeck (1983), and Entwistle & Waterson (1988) have all developed questionnaires aimed at identifying approaches to learning. An example is the Study Process Questionnaire developed by John Biggs (1987). In this questionnaire, students are asked to report on their normal approach to a wide range of aspects of the learning task. From these responses, it is possible to determine whether the student is intrinsically motivated to learn in depth in order to achieve a level of understanding, or is likely to take an approach of rote learning specific facts. The questionnaire also measures the extent to which achievement, in the sense of high grades, motivates the student. The questionnaire measures approach and strategy on each of the Deep, Surface and Achieving dimensions, which can be simplified to a dichotomy between Deep Achieving and Surface Achieving approaches. By using a questionnaire of this kind, insight can be gained into how particular groups of students approach their study, and also into the range of styles that are used by students in accomplishing a learning task.

Questionnaires measure a basic approach, however other measures have identified that this is not necessarily consistent for each student across every task. Laurillard (1984) found that the depth of learning aimed for and achieved by students, as identified by a procedure of asking the student to teach back the material that had been learned plus interviewing the students about the strategy used, would vary according to the student's perception of the importance of the task. This means that the quality of learning is influenced to a high degree by whether the student sees the task as worthy of deep study. Some students reported that if they thought the assessment would be a test of memory or recall, then an attempt to understand the material in depth was not necessary, and a more superficial approach would suffice. While the SPQ measures student approach, Laurillard used a qualitative measure of both approach and outcome.

The identification of depth of learning as an outcome has been identified by Biggs and Collis (1982), who developed the SOLO taxonomy to measure this. This taxonomy is used to classify responses to an open-ended question, in terms of the relationships the learner draws between the concepts learned and whether the learner is able to structure these according to an appropriate conceptual framework. By using a measure such as this, student learning can be classified according to the extent to which the student has created meaningful associations with the newly acquired knowledge, as opposed to the extent the student has memorised or reproduced the information.

Many of these aspects are the subject of ongoing study by academics involved with research into the quality of teaching and learning, as they are of value for the insights they provide into what it is about learning tasks that motivate students to learn effectively and perform well.

Depth of processing and CAL design

Depth of learning is associated in cognitive terms with the concept of depth of processing first identified by Craik & Lockhart (1972) as being a major attribute of effective learning. This concept refers to the extent of the meaningful network of associations that the learner makes when learning new material. Craik & Lockhart identified a hierarchy of levels of cognitive processing, with greater depth of processing associated with the extraction of meaning from the material being learned. This they associated with more effective and efficient learning, as the creation and development of meaningful relationships make the efficient processing of large amounts of information possible. They characterise processing as the manipulation of conceptual schema, with efficient processing of large amounts of information occurring through schemas that contain a rich association of relevant information.

The relationship of these aspects of the learning process to CAL development have been identified by Hannafin & Rieber (1989) who argue that the methods frequently used in the design of CAL programs, such as

- small learning units
- controllable sequences
- discrete discernible steps
- behaviourally defined objectives and performance criteria

do not encourage deep mental processes. This implication is developed further by Jonassen (1988), who identifies four levels of information processing strategies: recall, integration with existing schema, organisation of existing and new schema, and elaboration, involving using and making judgements on the material. For Jonassen (1988, plS4), CAL programs require what he describes as "generative learning strategies", such as "generating mnemonic memory aids, note taking, underlining, paraphrasing, summarising, generating questions, creating images, outlining, and cognitive mapping" to induce the learner to engage in an active process of constructing meaning during learning.

The argument presented by Hannafin & Rieber, and Jonassen, is that CAL programs are potentially superficial in the mental processes that the learner is required to engage in, and that the resultant learning is likely to be superficial. While this claim has intuitive merit in the sense that it is only by the student making an active response that learning is likely to occur or be effective, it may be oversimplified in that it does not take into account the mental processing that the student may engage in that is not required by the program, which may reflect the student's own learning style or motivation. This issue is investigated by examining whether depth of processing is an outcome even if programs do not, as most don't, use some form of generative learning.

Testing for depth of processing

The first issue is whether students do, in fact, learn in depth when using CAL programs. To do this an evaluation study was carried out on two tertiary level groups of students who, as part of their planned course of studies, used a CAL program to learn a particular aspect of their course.

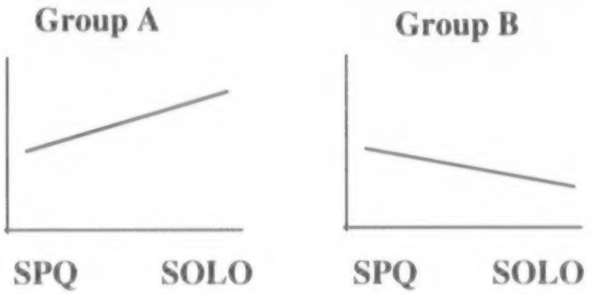
The testing procedure for depth of learning was carried out after the students had used the CAL program, and independently of it. The students were asked a question about the material they had studied which required an open ended and structured response. This question was assessed using the classification in the SOLO taxonomy, which assessed depth of learning in terms of the relationships the student constructed, and the structured nature of the student's response.

Each study provided a different pattern of responses, with one study showing a high level of SOLO responses, indicating an in-depth response by a majority of the students, and another study showing a very low level of student responses. In this second study, most learners reproduced elements of the information provided, without attempting to relate these elements in any way, either to other newly acquired concepts in terms of a structure, or to their own experience in a way that would indicate a process of assimilation with existing knowledge and cognitive structures had taken place. Some answers, showing a deeper, more related, response, were observed, however these were in the minority. These evaluations indicate a contradictory response to the issue, except to say that some students did respond in depth, however the studies were not directly comparable due to contextual and motivational factors that are considered below.

Depth of processing in relation to learning style

Research using the Study Process Questionnaire (SPQ) has indicated that many learners do not use an approach that would lead to a deep level response. The type of student approach that leads to memorisation of facts and procedures, rather than trying to understand the meaning and implication of these in relation to the learner's own cognitive process, will most likely result in a non-relational response when evaluated using the SOLO taxonomy. By examining the relationship between the student's tendency to learn in a deep or surface way, compared to the observed outcome of learning, more insight into the effectiveness of the learning program can be gained.

All students were asked to complete the SPQ questionnaire at the beginning of each study in order to provide additional information on the effect of the CAL program on learning. As the SPQ provides a measure of deep learning as an approach to a learning task, and the SOLO taxonomy provides a measure of depth of learning as an outcome of the learning task, a degree of correlation between the two scores can be expected. Studies by Biggs (1979) and Watkins & Hattie (1981) have established a correlation between the two measures, although the correlation is not necessarily strong.



The comparison between the SPQ and SOLO scores highlights the difference between the two groups of students evaluated. In Group A, in which a high level of SOLO responses was recorded, the comparison between the SPQ and SOLO scores shows a level of in-depth responses that is higher than the extent of the deep learning approach as indicated by the SPQ scores. In Group B. the level is lower, indicating that many students who are inclined to take a deep approach to learning did not respond in depth.

These differences can only have come about through the circumstances under which the learning took place, including the CAL programs used. Neither program used generative learning strategies, however there were other differences between the programs that partly explain the differences in the results. There were, however, differences in the context in which the programs were used that also partly explain the results. In order to identify all factors that may have affected student performance, additional data was obtained from the students by interview and questionnaire.

Interpretative data

In Group A, a selection of students were interviewed about their use of the program. From this data, a number of trends are apparent which illuminate the data from the SPQ and SOLO scores. The trends in the student responses indicate:

1. The students found the program easy to use.
2. The program fitted in well with the course, by providing information and learning activities that were important within the context of the overall learning task.
3. While the students also used other sources of information, including a lecture and a text book, they mostly reported that the CAL program was the source that required them to think most deeply about the topic.
4. The CAL program helped the students to form an in-depth understanding of the topic. Many students commented on the inclusion of a case study as being particularly helpful.

It must be noted that the students in group A were preparing for an examination question on the topic, and used other sources of information apart from the CAL program. This clearly influenced the motivation to study the topic, to the extent that some students reported taking notes from the program to use later. The question that was subjected to analysis using the SOLO taxonomy was the exam question on the topic.

Interpretative data was gathered from Group B also, this time by questionnaire. While the responses were not uniform, trends are apparent that indicate the following:

1. The students did not find the program easy to use.
2. The program content was seen to be related to the course content, however the reason for using the program was not clear to the students.
3. The program did not encourage the students to think deeply about the topic.
4. The program did not enable the students to form a deep understanding of the topic.
5. The students felt that the program did not provide enough information to effectively learn about the topic.

From this information it is clear that the programs differed from each other in terms of their effectiveness in meeting the learning needs of the students, in part because of the context in which they were used, and in part due to the effectiveness of the information provided and the learning activities required. Contextual factors are clearly important. The students in Group A saw a clear need for the knowledge contained within the program, and were happy to use it. Group B students, by contrast, did not understand why they were asked to use the program, and did not want to use it, despite the fact that the content was clearly related to their course of study. This aspect of lack of preparation is likely to have influenced performance.

It is difficult to assess by how much, however. The group A students were generally satisfied with the information provided by the program, and found it helpful in reaching an in-depth understanding, a self-report that is supported by the SOLO data. The group B students found it difficult to obtain the information that was needed, and reported that this did not provide a comprehensive explanation of the topic. These factors were clearly an important influence on the lack of depth that was generally evident in the results from this group.

Conclusion

The data from this study so far is not conclusive. Although neither program used generative learning strategies which, according to Jonassen (1988), means that the resulting learning will inevitably be superficial, many students in one group did show evidence of deep learning. As this group sat for an examination, it is entirely possible that the students used their own generative learning strategies, such as writing summaries, and that these were instrumental in attaining the in-depth learning as assessed by the SOLO taxonomy, even though they were not built in to the program. It is clear, however, that the programs differed markedly in their effectiveness as aids to learning. Further investigation is needed to establish the factors about program design that influence depth of learning.

References

Biggs, J. B. (1979). Individual Differences in Study Processes and the Quality of Learning Outcomes. *Higher Education 8: 381-394.*

Biggs, J.B. & Collis K.F. (1982) *Evaluating the quality of learning: the SOLO taxonomy.* Academic Press, New York.

Biggs, J. B. (1987) *Student's approaches to Learning and Studying.* ACER, Melbourne.

Craik, F. I. M. & Lockhart, R. S. (1972). Levels of processing: A Framework for Memory Research. *Journal of Verbal Learning and Verbal Behaviour* 11, 671-684.

Entwistle, N & Waterson, S. (1988). Approaches to Studying and Levels of Processing in University Students. *British Journal of Educational Psychology,* 58, 258-265.

Hannafin, M. J. & Rieber, L. P. (1989) Psychological Foundations of Instructional Design for Emerging Computer-Based Technologies: Parts I & II. *ETR&D,* Vol 37, No 2.

Jonassen, D. H. (1988). *Instructional Designs for Microcomputer Courseware.* Lawrence Erlbaum Associates, Hillsdale, N.J.

Laurillard, D. M. (1984). Learning from Problem Solving. In F Marton, D Hounsell & N Entwistle, *The Experience of Learning.* Scottish Academic Press, Edinburgh.

Schmeck, R. R. (1983). Learning Styles of College Students. In Dillon, R., and Schmeck, R. R. (Eds.), *Individual Difference in Cognition.* New York: Academic Press.

Watkins, D & Hattie, J. (1981). The Learning Process of Australian University Students: Investigations of Contextual and Personological Factors. *British Journal of Educational Psychology* 51:384-393.

Telematics for higher order learning: challenges and opportunities

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In Western Australia telematics (audiographic teleconferencing) is used to deliver curriculum subjects to students in remote and rural locations. Communication between students and teachers is achieved by combining telephone, facsimile and computer links, and by providing different levels of teacher-student interaction. Teaching via telematics overcomes many of the problems of remote and distant learners as lessons are transmitted from the metropolitan area to a number of sites simultaneously.

Previous research on telematics classrooms (McLoughlin & Oliver, 1995) indicates limitations on the forms that teacher-student interactions can take, and in particular the didactic teaching style that teachers adopt when teaching with audiographics.

A recent initiative by the Education Department of Western Australia is seeking to extend the use of telematics for delivery of educational services to gifted and talented students in rural and remote areas. The aim of the project is to extend and apply innovative approaches to teaching via *audiographics, and to foster higher order learning in the students by linking them with other students in the metropolitan and rural areas.*

The paper will outline an action research approach to developing a teaching-learning framework for application of telematics to learning environments seeking to promote higher order cognition.

The Western Australian Context

Audiographic teleconferencing, or telematics is widely used in Western Australia to deliver educational programs to rural and isolated schools. The technology combines computers for sharing graphics, telephones for two-way communication and facsimile for document transmission. The potential of telematics to deliver interactive and efficient instruction to remote sites is documented in the literature (Oliver & Reeves, 1994; Rehn, 1994; Stacey 1993: Oliver & McLoughlin 1995). In Western Australia, telematics normally refers to the use of a computer using the software *Electronic Classroom* . What distinguishes telematics is that audio, document and visual links are created via the technology. The learning environment does not enable face-to-face visual links between teacher and learner, and communication is mediated through visual and audio links.

Current Development in WA: The Academic Talent Program

In WA telematics has been used to:

(i) extend the curriculum subjects offered throughout rural areas. Clusters of schools have organised themselves to share resources and teachers so that all participating schools have access to a broader range of subjects. This was subsequently known as the Priority Country area program (PCAP).

(ii) to enable schools in rural areas (on the basis of equity and access) to receive specialist programs, such as LOTE; (Japanese, Italian and French are currently offered);

(iii) provide schools in rural areas the opportunity to have a specialised curriculum, (as part of the Academic Talent Program) via telematics and to have access to the same range of programs as schools in the metropolitan area. In addition, it is anticipated that by linking schools in the metropolitan and country areas, talented and gifted students will benefit from collaborative activities and exchange of views.

The Academic Talent Program via Telematics

The curriculum frameworks for the Academic Talent Program (ATP) were developed to encourage and support the development of students' cognitive, social and emotional well being regardless of location, gender or social class. The curriculum frameworks are couched in terms of outcomes, or performance and demonstrated ability. Outcomes based education has the following characteristics (Willis, 1994).

- An outcome is a demonstration of learning that occurs as a result of a learning experience.
- Outcomes-based education is based on specific outcomes. Curricula are designed to achieve such outcomes. Courses are evaluated in terms of their capacity to help students' attain stated objectives.
- The academic talent program, in addition to espousing outcome statements, also seeks to develop as integrated curriculum by extending relationships between the disciplines.

The particular higher-order learning outcomes as stated in the curriculum framework involve:

- independent learning strategies
- information handling and synthesis
- independent learning
- reflection and analysis to generate and refine knowledge
- question generation and analysis
- presentation of arguments
- effective communication
- participation in group work.

Teachers are provided with curriculum guidelines enabling them to develop teaching programs which extend, enrich and accelerate talented students in a special program tailored to their needs. The provision of such a program via telematics presents interesting challenges.

Telematics as Medium for delivery of Educational Programs

Research into the effectiveness of audiographics as a medium for delivery has yielded considerable insight into the pedagogic practices of teachers, their attitudes towards implementing the technology and the constraints it imposes (Stacey, 1993; 1994). In distinct education, communication between the teacher and the learners is still the critical features of the learning process, though it is mediated electronically in telematics. Pervasive in the literature is the belief that telematics is "second best", a poor-alternative to face-to-face teaching. Not surprisingly, such negative attitudes are likely to affect teachers' perceptions of the effectiveness of the technology.

Many of the guides to telematics teaching stress the need for a facilitating role for the teacher (Elliott, 1991; Conboy 1992, 1991) and a consequent reliance on student responsibility, resource based approaches and expectations that students will assume responsibility to a greater extent than they would in a classroom. It has also been observed that students must take more responsibility for their own learning as the physical absence of the teacher means that students have to take the initiative to ensure that equipment is functioning, provide feedback to the teacher on how the lesson is being received. For teachers, some of the difficulties documented included:

- conducting an effective lesson without eye contact
- trying to get to know students without seeing them
- lack of feedback from students
- feeling of pressure and stress in trying to involve all students actively
- lack of instant visual and graphical communication.

One of the contradictions that emerges from the research on telematics teaching is that while teachers depend on highly motivated, co-operative students for the success of the lessons, they rarely make their lessons fully learner-centred, and persist in retaining control over the pace and sequence of interactions at all stages. The inherent contradiction between the desire to achieve a motivating, interactive learner-centred environment and the effort made by teachers to maintain control over all aspects of teleteaching is another striking feature of reports on telematics classrooms.

Interactions in Telematics Classrooms

In audiographics environments, studies (Oliver and Reeves 1994; Evans and Nation, 1992) indicate that limitations on interactions often result from the technology, the teacher's management strategies, or a combination of both. Didactic forms of teaching are observed to be prevalent. Evans and Nation (1992) reported that their observations confirmed that teachers felt compelled to use the audio link to compensate for lack of visual cues and this resulted in the lessons being didactic and interrogative. The adoption of a teacher centred approach was evident in teachers' persistent questioning of students. Clearly, the main agenda for teachers was maintaining control and discipline in their teaching and the technologies appeared to support this approach.

These findings are confirmed by Oliver & Reeves (1994) who reported that teachers exerted control over the dialogue through :

- leading questions that required no answers;
- questions that were answered by the teachers after short delays;
- questions that could not be answered;
- setting task for students; *and*
- directives to individual students.

It was also observed that there was an inverse relationship between teacher dialogue and student verbalisation throughout the lesson: as student responses diminished, teacher talk increased, resulting in a decrease in interactivity. These findings are related to the critical link between learner control and interactivity. If there is asymmetry in power relations and control of dialogue, meaningful teacher-student and student-student interaction will not ensue .

In reporting on teachers' experiences, Squires and Sinclair (1993) reported that teachers very strongly felt the absence of visual cues. Given the importance of non-verbal exchanges in communications generally, this is hardly surprising. Changes to teaching strategies reported by instructors included:

- reliance on diagrams using the electronic classroom;
- need for clear instructions;
- more verbalisation;
- accurate time allocation and management;
- student centred approaches;
- use of aural cues;
- use of printed materials for a discussion focus;
- questions directed at particular students;
- advance planning.

These experiences appear to be widespread across contexts and locations. Observations of classrooms in Western Australia (Oliver & Reeves , 1994) and in Victoria (Evans & Nation, 1993) affirm that the pedagogies adopted by teachers using the technology are limited, interrogative and didactic, not conducive to searching or deep level inquiry by learners and narrow in range and focus. As a result, telematics classrooms tend to have a number of clearly identifiable characteristics. Teachers tend to take prime responsibility for setting the academic agenda, organising lessons and directing student behaviour. Consequently, classroom discourse is adversely affected, with students merely reproducing knowledge, or responding to questions posed by a teacher. The resulting pattern is one of initiation (I) by the teacher, response by a student (R) and evaluation (E) by a teacher. This IRE pattern has been acknowledged as typical of teacher fronted classrooms (Cazden 1988; Edwards & Mercer, 1987: Mehan 1979). Not only do teachers dominate classroom, they also control turns at talk. Opportunities for initiation, student -generated questioning and inquiry are constrained by this formalised pattern.

In summary, the literature (McLoughlin & Oliver, 1995) confirms that telematics environment tend to have the following characteristics:

(i) passive rather than active learning

(ii) teacher control over the pace, sequence and form of the lesson (learners are dependent on the teacher as a consequence of these pedagogies)
(iii) learners do not monitor their own performance.

Clearly there are challenges ahead to the implementation of a successful academic talent program using telematics as a medium for delivery.

Higher Order Learning: Challenges and Opportunities

What is higher order learning and what challenges does it present to the telematics teacher? Critical thinking is inherent in all academic tasks which involve reading, writing, arithmetic and problem solving. For example, writing involves the ability to analyse, synthesise and organise information, in addition to being able to monitor one's own performance.

Another view is Resnick's (1987) theory that higher order thinking cannot be defined exactly, but is recognisable when it occurs. Some of its essential properties are that it is :

- non-algorithmic
- complex
- self-regulated
- effortful
- applies multiple criteria

This occurs when problems are exposed which cannot be solved through recall and application of previously learnt knowledge. What is required for problem solving is a form of creative thinking or "going beyond the information given" (Bruner 1971). Higher level thinking is regarded as a desirable educational goal as it is linked to achievement, effective problem solving capacity and greater self-realisation (Rowe 1993; Mayer 1992). The contexts that produce higher level thinking are diverse, and include processes of reading and mathematical understanding. Thinking skills are teachable and learnable, and processes that are regarded as influential in cultivating thinking and reasoning skills in the classroom are:

- engagement in collaborative learning processes
- tackling problem solving tasks.

In addition, discourse which involves a high level of learner initiation is indicative of higher order learning processes. Previous research provides evidence that the following categories of talk are indicators of higher order thinking and learning.

- explanations and elaborations (Webb, 1989);
- specific questions and counter assertions (Meloth & Deering, 1994);
- question generation (Hilton, 1990; Graesser, 1994);
- detailed explanations of problem solving behaviours (Webb, 1991);
- demonstrating level of understanding (Webb, 1994);
- giving elaborate explanations to peers (Webb, 1989);
- task related questioning and strategy elaboration (King, 1989);
- guided co-operative questioning (King & Rosenshine, 1993);
- giving and receiving elaborated help (King & Farivar, 1994);
- question generation and explanation (King 1992).

There is a well recognised need for educators to focus their efforts on improving these higher-level cognitive skills to enable children to become independent and productive learners and thinkers. With rapid technological change students clearly need to learn not only subject matter, but also new information handling skills and analytical strategies they will require throughout their lives.

Can Higher Order Thinking Skills be Taught Via Telematics?

Clearly, different pedagogical outcomes require different particular patterns of interaction. Demonstrating to teachers the range of options in teaching approaches together with increasing awareness of the impact of their teaching practices on student behaviours is a step in the right direction. Teachers can become more aware of their teaching approaches and attendant limitations by viewing the behaviours of their students as they learn via telematics. This is best achieved by videotaping the lessons delivered to the remote site. Teachers then engage in action research by looking at the classroom situation, developing a practice in response, trying out the practice, observing what happens and revising the practice as necessary. Teachers involved in the Academic Talent Program now ask questions such as:

- *How do high ability students respond to the tasks and activities in my lessons?*
- *Are these learners engaging in higher order cognitive processes, problem generation, reasoning and critical thinking?*
- *What teaching strategies can I use to establish meaningful learning experience for students to develop higher order learning?*

Instructional Design Framework for Higher Order Learning

In order to orchestrate interactions leading to higher order learning, three dimensions to a design framework were considered for telematics teaching, using constructivist approaches to learning (Duffy, Lowyck and Jonassen, 1993). A sketch of the issues that need to be considered are as follows:

1. *Role of the teacher in the learning process.* To what extent is the teacher an authoritative provider of knowledge as opposed to a resource? What additional roles could teachers perform, other than to initiate questions and mange the lesson?
2. *Role of the student.* How can students demonstrate autonomy, self direction and ownership of the activities throughout the lesson? How can they be encouraged to engage in higher order processes such as evaluating and problem solving?
3. *Teaching strategies.* What teaching methods and corresponding activities should be used to achieve the instructional goals of higher order learning? How should these activities be sequenced to optimise learning?

These issues inform the framework adapted from the research of Shuell (1988) depicting the role of the learner in instruction, and incorporate the findings of Kinzie (1990) who investigated the requirements of successful instruction. Kinzie (1990) defined the essential elements of self-regulated learning as enabling students to control their own learning, thereby increasing motivation and engagement. Telematics environments have the potential to foster self-directed and autonomous learning through appropriate use of the technology and orchestration of interactions with learners.

A preliminary step in the creation of a framework to guide telematics teachers is to specify the essential functions a learner must engage in to learn from instruction. This contrasts with the observed patterns of interaction observations of telematics classrooms (McLoughlin & Oliver, 1995) where teacher talk dominated and there was little evidence of student participation or engagement in cognitive, affective or metacognitive functions.

The framework is intended to enable teachers to help learners take appropriate steps to control their learning by creating opportunities for dialogue and reciprocal action. The aim is to orchestrate the learning experiences so that increased learner input and control is fostered. In this way, the telelearning environments can bring about progressive, social, interactive participation where learners can develop cognitive and metacognitive strategies to enhance their own learning. Table 1 represents those functions which the teacher initiates in order to bring about learning, but most importantly, shows that at every stage the learner must also be engaged in a reciprocal action.

Summary and Conclusions

This article began by noting the limitations of telematics environments, and the didactic teaching style adopted by many teachers as they try to accommodate their teaching styles to the medium. In order to maximise use of the technology for delivery of lessons to remote learners while meeting the requirements of the academic talent program, the emphasis has been on self directed learning and authentic interactions as key strategies to guide the creation of such environments. The focus of the framework is to enable teacher to create an environment which is meaningful to students, enabling them to take responsibility, pose questions and self-evaluate their own learning. The verbal skills and strategies that students employ are key elements of the framework as it is through the discourse of such verbalisation that higher order cognition can be evaluated.

The framework is only a starting point for developing higher order learning. Observations of the learners as they engage in problem generation, critical analysis, consideration of alternative solutions and evaluation of alternative perspectives will lead to better understanding of how telematics environments can be designed to enhance higher order learning.

Function	Teacher initiated	Student initiated	Active Learner Role/Strategy
Lesson objectives	specify instructional outcome	identify or state purpose of lesson state expectations	self-direction (metacognitive)
Building on prior knowledge	discuss context, investigate level of understanding	present examples, discussion and brainstorming	learning strategies, mnemonics
Supporting student responses	explains, cites examples, contextualises	generates examples, creates images	elaboration, verbal extension
questioning	asks questions checks understanding	self questioning, hypotheses generation, asking "what if questions?"	stimulation of curiosity, internal processing
feedback	provides positive and negative feedback correct responses	group monitoring, self testing	self regulation
evaluation	asks students to evaluate their own performance	express what is known, not known identify gaps in understanding	personal causation and involvement

Table 1: Guided Learning Model to promote higher order learning

References

Bruner, J. S. (1971). *The Relevance of Education.* Harmondsworth: Penguin.

Cazden, C. (1988). *Classroom Discourse.* Portsmouth: Heinemann.

Conboy, I. (1991). *The Telematics Manual.* Victoria: Ministry of Education.

Conboy, I., Elliott, N., & Martin, D. (1992). *Teachers Train, Students at Risk Gain.* Victoria: Department of School Education.

Duffy, T., Lowyck, J., & Jonassen, D. (Ed.). (1993). *Designing Environments for Constructive Learning.* Berlin: Springer-Verlag.

Edwards, D., & Mercer, N. (1987). *Common Knowledge: The Development of Understanding in the Classroom.* London and New York: Routledge.

Elliott, N. (1992). *The Telematics Manual.* Melbourne: Ministry of Education, Victoria.

Evans, T., & Nation, D. (1992). Teachers' experiences of teaching by telematics: some preliminary research findings. In *Australian Association for Educational Research Conference,* . Deakin University, Geelong: Deakin University Press.

Evans, T., & Nation, D. (1993). Adapting Classroom technologies for Distance Education: telematics in Victoria. In T. Nunan (Ed.), *Distance Education Futures,* (pp. 105-113). Adelaide: Australian and South Pacific External Studies Association.

Graesser, A. C., & Person, N. K. (1994). Question asking during tutoring. *American Educational Research Journal,* 31(1), 104-137.

Hilton, D. J. (1990). Conversational processes and causal explanation. *Psychological Bulletin,* 107, 65-81.

King, A. (1992). Facilitating Elaborative learning Through Guided Student-Generated Questioning. *Educational Psychologist,* 27(1), 111-126.

King, A. (1994). Guiding knowledge construction in the classroom: effects of teaching children how to question and explain. *American Educational Research Journal,* 31(2), 338-368.

King, A., & Rosenshine, B. (1993). Effects of guided cooperative questioning on children's knowledge construction. *Journal of Experimental Education,* 61(2), 127-148.

Kinzie, M. B. (1990). Requirements and benefits of effective Interactive Instruction: Learner control, self-regulation and continuing motivation. *Education, technology research and development*, 38(1), 5-21.

Mayer, R. E. (1992). *Thinking, Problem Solving and Cognition.* New York: W.H. Freeman and Company.

McLoughlin, C., & Oliver, R. (1995). Analysing interactions in technology supported learning environments. In R. Oliver & M. Wild (Ed.), *Australian Computers in Education Conference*, 2 (pp. 49-62). Perth, WA: ECAWA.

Mehan, H. (1979). *Learning Lessons: Social organisation in the classroom.* Cambridge MA.: Harvard University press.

Meloth, M. S., & Deering, P. D. (1994). Task talk and task awareness under different learning conditions. *American Educational Research Journal*, 31(1), 138-165.

Oliver, R., & Reeves, T. (1994). *Telematics in Rural Education.* Perth: Intech Innovations.

Rehn, G. (1994). Audiographic teleconferencing: the Cinderella of interactive multimedia. In C. McBeath & R. Atkinson (Ed.), *Second International Multimedia Conference*, (pp. 468-477). Perth: Promaco Conventions.

Resnick, L. B. (1987). *Education and Learning to Think.* Washington DC.: National Academy Press.

Rowe, H. A. H. (1993). *Learning with Personal Computers.* Victoria: ACER.

Shuell, T. J. (1988). The Role of the Student in Learning from Instruction. *Contemporary Educational Psychology*, 13, 276-295.

Squires, D., & Sinclair, R. (1993). *"I can be near my horses" :An evaluation of the Department of School Education's Pilot Access (telematics) Program.* Bathurst, New South Wales: Charles Sturt University.

Stacey, E. (1994). Technology overcomes Australian Distances. *Technological Horizons in Education*, *21*(6), 56-59.

Stacey, E., & Turner, L. (1993). Telematics-a practicum of the future? In *ASPESA*, . Adelaide:

Webb, N. (1989). Peer Interaction and learning in small groups. *International Journal of Educational Research*, 13, 21-40.

Webb, N. M. (1991). Task-related verbal interaction and mathematics learning in small groups. *Journal of Research in Mathematics Education*, 22(5), 366-389.

Willis, S., & Kissane, B. (1994). *Outcomes Based Education.* Perth: Education Department of Western Australia.

Establishing Distance Education Networks in New Zealand: Policy Parameters

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Decentralised system

In 1989 the New Zealand education system was reformed. The central bureaucracy was dismantled, and the governance and the management of every school was placed in the hands of its own board of trustees. The logic of the reform rests on the efficiency of decision making being placed closest to where its effects are felt. School communities are the best placed to decide what is best for their children's learning.

The role of the state through the Ministry of Education is that of property owner, policy maker, funder and regulator only. The state lays down curriculum requirements in the form "Schools must ensure that students have the opportunity to achieve the national achievement objectives which are defined in the New Zealand curriculum". School boards are required to ensure that achievement is monitored and reported to the community.

Schools are funded individually to deliver their curriculum responsibilities. The funding is viewed as a purchase arrangement where the government purchases the delivery of the curriculum from schools.

The purchase price, or amount of funding each school gets, depends primarily on its size and roll characteristics. A school's funding comes in two components — an "operations grant" and a teaching salaries component.

Schools get an operations grant from which to pay all bits for services, equipment, maintenance, and so on. The operations grant pays salaries of all non-teaching staff. The operations grant is not :"tagged" in any way — a board of trustees has entire discretion over deciding about, and purchasing from commercial providers, all resources required to support the satisfactory delivery of the curriculum (including computers and software, for example.) The size of a schools operations grant is calculated on a roll-related formula. Inevitably there is perennial discussion between the schools and the government over the adequacy of the operations grant.

Boards select and employ their own teaching staff but have a choice as to the way they wish to receive their teaching salaries resource. A staffing entitlement number is determined by rollrelated formula. Boards may choose to employ the entitlement number of staff and have them paid from the centre, or they may choose instead to have a bulk salaries grant — equivalent to the salary bill of their central staffing entitlement — added to their operations grant, after which they may employ whichever and as many staff, above or below entitlement, as they wish.

Some schools are entitled to additional supplementary funding provided that they meet certain criteria related to particular student needs. For example, some schools receive entitlement funding based on SES equity criteria (TFEA), and there are (contestable) application pools of funding available to schools which meet criteria relating to:

- special education needs (students at risk) Maori language support
- tertiary level programs (secondary-tertiary alignment resource) rural 'disadvantage'.

Purchase of other outputs on behalf of schools

The Ministry of Education contracts out to third parties for the provision of some services on behalf of schools, for example, curriculum development, teacher professional development, and research.

In a few cases selected schools have been offered contracts to undertake pilot or research and development activities. The CASATECH project, described in the paper, was begun from such an arrangement.

Importance of local initiatives school — Business &/or community partnerships

The government is keen to see the relationship between schools and the business sector grow. Partnerships between schools and business may well have resource benefits for schools, as in the CASATECH case. But equally importantly, successful dialogue between school managers, teachers, and students, and business managers and operators may ultimately benefit students as their education may be more attuned to the business view of the real worlds while the business sector view of schooling may itself be brought up-to-date

An interesting development, in the context of the logic of decentralisation, has been the "cubbing together" of groups of schools to negotiate bulk supply deals with providers of goods and services. Some of these arrangements have been very successful as will be demonstrated later in this paper.

Government Initiatives in Distance Education

There is a long history of traditional distance education in New Zealand. New Zealand's correspondence school was established in 1922 and operated for more than 70 years using snail mail and radio, supplemented by occasional visiting teachers. But distance educators have been innovative and have not been slow to invoke information technologies. Distance education in New Zealand now uses a wide variety of technologies including interactive TV, computer disc mailouts, email and on-line audio-graphic link-ups.

Government Initiatives in IT

Ever since the first "Consultative Committee on Computers in Schools" in 1982, and before the government reform which saw the new Ministry of Education established, the government has kept a cautious watching brief on the impact of information technologies in schools.

We have a long history of exploratory or model programs in which small amounts of funding have been made available to pilot schools to test or stimulate innovative approaches to the use of information technologies. In the latter days of the former Department of Education there was even a Computers in Education Development Unit dedicated to IT in schools.

New Zealand schools traditionally have supplemented any government funding with locally raised funds. Prior to the restructuring of education locally raised funds were the main source of revenue for information technology purchase.

In spite of the lack of direct government input, the rate of uptake of information technologies by schools has been encouraging. Student computer ratios in New Zealand schools compare favourably with most other Western countries.

In 1994 the Ministry's internal information technology system was extended to pilot a "Schools Net" backboned by the government's nationwide payroll network infrastructure. This pilot is moving to Internet protocols with the Ministry maintaining a WWW 'home page". It was always planned that the Schools Net would eventually be "spun off" to private enterprise.

Recently, some schools have been able to supplement operational grants, through R&D contracts with the Ministry, or by successfully bidding for contestable funding.

R&D contract funding enabled the establishment of four "technology development" secondary schools. These schools were to provide models for the implementation of the new Technology as well as leadership in the use of information technologies across the curriculum.

An R&D contract also enabled the Correspondence School recently to embark on a project using interactive TV via both satellite and terrestrial links, mainly for foreign language programs. These programs are to be accessibly urban schools as well as traditional users of distance education because, in common with many countries, New Zealand has a shortage Of skilled teachers of foreign languages. This technology is, of course, not new for Victoria.

Both R&D contract funding, and successful bids for contestable rural "disadvantage" supplementary funding, have enabled the establishment of a number of regional networks based on audio/video graphic linkups. The CASATECH project was the pioneer of these programs.

Establishing Distance Education Networks in New Zealand: Practicalities Past, Present and Future

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This year there are five school networks currently functioning in New Zealand around the cluster of schools model with two others preparing to move in this way. The schools cluster model using audiographics began in 1993. Canterbury Area Schools began to plan a cooperative project in that year to try to meet the various needs of their rural and urban communities. The project was under way by the beginning of 1994 embracing seven schools: Akaroa, Amuri, Hawarden, Oxford and Twizel Area Schools together with Christchurch Rudolf Steiner.

The CASA(Tech) Project

1 Administrative issues affecting schools at that time

i Difficulties in establishing the network

To know that the finance was available to cover equipment, professional development, on-line time, establishment meetings and day to day running costs. At the time of setting up the Ministry grant did not cover equipment costs and a further $26,000 had to be found for equipment.

To know where to tap into existing knowledge and expertise in New Zealand.

To establish relationships with local computer firms who did not have the expertise to know, or the vision to see what was required.

First on-line lessons were often lost because of teacher inexperience and difficulties with the configuration of the bridge in Wellington.

Older telephone exchanges gave intermittent problems.

The speed of the chips in the computers was variable and the chips had to be replaced.

Light pens sent from Canada were faulty.

Manuals to assist teachers were not available.

ii Organisational issues

Common times had to be developed across schools in the network. The next step was to build a school timetable around those common times.

Coordination among site directors was a problem at times. All teachers who do this work have a full range of duties anyway and this is another additional task.

Lessons had to be much more tightly structured.

Lessons had to be fitted around sports/cultural events at more than one school.

One extra period of non-contact was necessary for on-line teachers. It takes time to scan in materials before lessons.

In administration tight controls had to be developed to control postings and faxes etc.

iii Costs invoked in developing and maintaining technology

Some schools have been fortunate in keeping costs so far to a low level because: the equipment has been totally dedicated to audiographics; there has been sufficient expertise on the staff to "trouble shoot"; and students have been supervised when using the equipment. Some of the other schools have experienced difficulties when computers malfunctioned because the local firms had insufficient knowledge, the time delay and costs in sending the machine to the experts in Wellington were unsatisfactory.

Hidden costs have occurred when schools switched to the windows version of Vis-a-vis and then found that the RAM capacity of the machines was insufficient to cope. This had to be addressed rapidly because costs of sending graphics online soared because of the time delay.

iv Training provided for staff.

In November 1933 the first one day session was held at the Christchurch College of Education to plan the courses and examine the teaching methodology required. Formal sessions for staff mixed with a teaching program for students were held over two days in February 1994. The initial training for using the equipment was given by the firm who has supplied it. The costs of installation (at each site) and training at Oxford were much higher than expected. The handbook prepared for the project was checked by the teaching staff.

Later that term a one day course was held at College to iron out difficulties which had occurred with equipment and teaching techniques. During the year several on-line sessions were held with teachers discussing problems and also discussing with the business firm concerned scanning and bridge difficulties which had occurred.

At the end of 1994 both teachers who had experienced the network and those who were starting in 1995 met for three days at the College of Education to prepare for 1995 by providing training and to revise the handbook.

v Technical support

Technical support was very important in the early stages of the Project. This was not always easy to come by as was mentioned earlier. Distance and time delays were the factors. It became imperative in order to maintain momentum that technical support was locally and easily accessible to prevent real frustration.

2 Teaching and learning issues

i The impact on the professional development of teachers

We all learnt that this type of teaching does not suit all teaching styles. Like the students, some teachers enjoyed the medium while others found the technical difficulties combined with the intense lesson preparation required very draining. All the teachers felt that their questioning techniques improved significantly and they developed skills in "reading the students" without the assistance of body language.

ii Course development in the network

Course development is done prior to the course beginning. In the first year those teachers who were involved did not have a break over the Christmas period because of the work involved. We have failed to give enough support in this area for new teachers. We would like to do significantly more to assist them. Student choice drives the courses we offer. These are made in October/ November of the preceding year.

iii Inter-institutional cooperation

We all need to have an appreciation of the other schools in the network because we each timetable and run courses in different ways. Ensuring commonality in the project without interfering with each school's autonomy is important. In the beginning the principals met monthly to explore the issues.

iv Measurement of educational objectives and outcomes

The following techniques to evaluate student achievement and progress have been used:

- questionnaires to staff and students alike;
- individual and group interviews of classes;
- end of year results;
- teacher comments; and
- parent comments.

V Evaluation planning

The project was formally evaluated by the Ministry of Education (McKinnon report) at the of the first term 1994.

vi Benefits of using audiographics

The schools have been given a much higher profile within the communities. Students involved feel 'specials because they know that they are learning in a different way. It has given our teachers a much higher profile. Their knowledge and expertise are valued by their colleagues. As mentioned earlier those teachers have been given opportunities to enhance their skills. Visitors come to the schools to observe and learn. The above comments need to be tempered with the realisation there is still some scepticism and the general acceptance will take time.

3 Why did we start audiographics?

i. We wanted to give our students wider curriculum choice.

In 1991 and 1992 all the principals in the CASA group expressed concerns at the way curriculum provision for senior students would be provided in the future. We all felt that given small numbers particularly at years 12 and 13 the curriculum range needed to be extended in preparation for National Certificate. The conclusion we reached was that information and communication technologies had something to offer us.

Wider access to learning opportunities has been achieved for the students. All subjects which were offered at the beginning of the year have been maintained. The numbers of students involved has remained very high indeed. Three students have dropped out from courses. One in graphics and design, and two from physics. In all three cases there were problems with other school subjects as well. Thirty four students began Japanese at the beginning of the year and this has dropped to thirty one.

The final figures for 1994 were:

Year	11	Agriculture	7 students
	12	Accounting	9 students
	12	Graphics and Design	2 students
	12	Economics	14 students
	12	Physics	8 students
	13	History	8 students
	9	Japanese	31 students

Wider choice of learning opportunities has undoubtably been achieved for our students. More importantly the evaluation we have undertaken shows quite clearly that students have acquired other skills which will prove to be of enormous value to them individually. The skills of independent learning initially proved extremely frustrating for the students but have subsequently been valued by them. The seventh form history students commented that correspondence was much easier to do, all the material was given to them. With the one audiographics session each week students were required to do their own research. Lessons were focused on the work they had done and therefore they were much more exposed.

It is also important to realise that there was some vetting of students before they started the courses in the same way that is done for correspondence.

Teachers who have taught a class internally as well as audiographics remarked that assignments from on-line students were more thorough and reached a higher standard than those of the internal class. The Japanese teacher also remarked on the quality of pronunciation of students. Again the levels of concentration have to be high. There is no body language or face to see to assist in interpretation.

ii Starting again

If we were to do this again we would not change very much. We would like to ensure that technical support and professional development was in greater evidence. In other words more time needed to be spent on induction and providing working equipment.

iiii Cost benefits of being a technology school

There were no cost benefits for us. The project absorbed more staffing and costs more than providing conventional teachers in a classroom. However, we felt that the opportunities that were for the students are paramount.

Audiographics is an expensive option at this stage. Particularly in the setting up stages. It is difficult to take large classes because the interaction is lost and the lesson merely becomes one of show and tell. The equipment is expensive as are the on-line costs. A room in the school has to be set aside for the teaching as well. (Frequently this has resulted in refurbishing with carpet and curtains to cut back the echo effect.) In addition, support must be given to the students in the school which is receiving the lessons. With younger students and larger numbers a teacher must be with them during the on-line times to make the most effective use.

Toll costs are high in New Zealand. We were fortunate to have negotiated a bulk price for two years with Telecom and this kept our costs down. During 1994 and 1995 these costs had to be found from the schools' existing operations grant.

The Present

CASA(Tech) has now enlarged to include ten schools. As the additional institutions are form one to seven schools the name has been changed to Canta(tech) to more truly represent where the schools are based. (Canterbury) Other networks have now been established in New Zealand:

Tosi(tech) which involves schools in the top halt of the South Island;
Central(tech) which has some high schools in the bottom part of the North Island.
Ngata Memorial College in the East Cape
Rangitikei College Project

Several others are in the developing stage such the Northland Project which has been funded by the Ministry of Education. (Nasatec) The enlargement of the networks has been brought about by changes in Government policy. A rural school pool has been established whereby schools can apply for funds providing they meet the necessary criteria.

For Canta(tech) schools the scope of work covered has been considerably increased with 22 classes this year on line and 182 students involved. The subject range is wide as most of them are leading to National Qualifications at years 11, 12 and 13. In addition languages are being taught at lower levels of the schools. The growth for this project is a direct result of the extra funding from the Rural Schools Pool.

The Future

Developments for Canta(tech) in 1996 and 1997 hope to include

- developing a strategic IT plan this year for Canta(tech). From this development each school will then modify its own developmental plans alongside it.
- installation of ISDN, internet and routers in all 10 schools
- strengthen staff training programmes
- use supplementary audio time for the weekly on fine lessons
- upgrade all software to the T120 compliant
- use the on line classes for accelerant classes
- extend the use of phones, modems etc throughout our schools
- upgrade hardware

- improve the ratio of preparation time for on line teachers
- network our schools with category five cable

Many of these developments will be dependent on sufficient Government funding being made available.

At a recent Area Schools Conference in Wellington Ken Steven, Senior Lecturer in Education at Victoria University spoke about the rise of a tele-Learning paradigm in our schools which supports the new era of individualised learning. The growth in New Zealand of audiographics, satellite projects and the uptake of the internet use all lend weight to his argument.

Factors Affecting the Integration of Computers in Western Sydney Secondary Schools

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Integration is based on the assumption that computers should be an integral part of the learning process at all levels (Lockard, Abrams & Many, 1994), that is, the tool should service curriculum needs first and then be an object for study. However, the integration of computers into everyday classroom activity has proved to be more slow and difficult than many may have expected it to be (Collis, 1988), giving rise to the notion that there are incentives and barriers at work enhancing the adoption of technology in some schools while effectively blocking wider acceptance in others.

A study was formulated to explore the Western Sydney experience of the integration of computers across the Secondary School Curriculum. Six schools agreed to participate. The study used a survey drawn from the literature on teachers' intentions to use information technologies as teaching strategies. Data were analysed to reveal seven broad categories; Anxiety, Self Confidence, Perceived Relevance, Pedagogical Practices, Staff Development, Access to Resources and Policy Formulation, which explained teachers' intentions to use computers. Data about Teacher Computer Skill were also tabulated.

One-way analysis of variance (ANOVA) was used to compare groups of teachers based on perceived computer skill and the seven categories. The results showed significant differences (p2 0.01) between groups on the Anxiety, Self Confidence, Perceived Relevance and Pedagogical Practices scales. In order to determine how groups differed, post hoc analysis using the Newman-Kuels technique was used.

A Theoretical Perspective

The growth and acceptance of computers in our schools has been nothing short of spectacular, or has it? There is certainly evidence worldwide (Pelgrum & Plomp, 1991) describing the phenomenal infusion of information technology in schools. Similarly, research findings have made it clear that computer applications have undeniable value and have an important instructional role to play in classrooms (Roblyer, Castine & King, 1988). However, the acceptance, or more precisely the role of information technology in the classroom remains problematic.

The question of how schools can best use their computing resources to bring about positive and lasting effects upon student's learning has resulted in the development of two broad sets of curriculum practices (Bigum, 1990; Hodson, 1990; Wellington, 1990). These are:

i. Learning about the computer and its impact upon society — ie. computing studies.
ii. Learning with, through and from computers — ie. Computers integrated Across the Curriculum.

Today, both sets of curriculum practices command a significant proportion of schools' resources (Bigum, 1990). During the 1980s though, curriculum practice emphasising learning about computers gained dominance. Hodson (1990) stated that specific subjects were developed to teach about computers because they provide a highly visible and traditional secondary school response to problems, problems in computer education that Morton (1994) identified as:

i. a lack of range and quality of software alternatives;
ii. high establishment costs relative to other teaching / learning tools;
iii. a lack of familiarity by teachers of how to promote learning through and from computers (p.208).

The popularity of this approach to computer education has not been without its critics (Adams, 1992; Bigum, 1990; Wellington, 1990). Bigum questioned the legitimacy of learning about computers, suggesting that the conspicuous position of Computing Studies has arisen without real debate. In Great Britain, Wellington argued there were significant economic pressures behind the push for students to learn about computers.

During the 1990s, the pendulum has begun to swing in favour of learning with, through and from computers across the curriculum. That shift has reflected a growing awareness of the disadvantages of specialised computing subjects — fragmentation, mystification and academicisation (Hodson, 1990) — and an increasing consciousness of the interactive nature of computers, as tools for learning and discovery.

This awareness owes much to the many empirical studies of computer use in teaching and learning. Findings of many of those studies have subsequently been combined using meta-analysis techniques. Meta-analysis is a research synthesis methodology used to transform the features and outcomes of a set of related empirical studies into quantitative measures, which can then be used to calculate a measure known as an effect size. As a research tool, the power of meta-analysis arises from the ability of the researcher to summarise the breadth of the literature and generalise about relationships (Borg & Gall, 1989).

A key focus of early meta-analytic studies was the relationship between interventions involving computers and student achievement, as measured by test scores (Burns & Bozeman, 1982; Kulik, Bangert & Williams, 1983). The studies found learning involving computers was as effective as traditional instruction or resulted in greater gains for students. In summarising these findings, Kulik (1985) concluded that students whose learning experiences involved computers generally spent less time learning, learned more in class and remembered it longer.

A more recent meta-analysis using empirical studies not included in earlier syntheses (Khalilli and Shashanni, 1994), concluded that while computer applications remain an effective means of improving students' academic achievement these gains were greatest when simulation and problem solving tools are used. A meta-analysis of studies reporting cognitive performance . (Liao and Bright, 1991), also found evidence suggesting that the use of simulation and problem solving software impacted beyond specific content, affecting student's planning skills, reasoning, logical thinking and ability to transfer.

Despite growing support for computers as tools for learning and discovery, why is there a general unwillingness among teachers and schools to promote the use of computers across the curriculum? According to Collis (1988), the advocates of integration have failed to account for the reality of school life. The lack of appropriate teacher role models for those teachers implementing and managing computers in their classrooms is a fundamental cause of the problem. Complicating the situation is that those role models who do exist, are generally computing studies teachers using computers in laboratory situations. Wellington (1990) believes that the physical obstacle of computer rooms and the more subtle obstacle of computing being the domain of mathematics / computer studies boffins inhibits the spread of computers across the curriculum.

The existence of subtle obstacles suggests that teacher beliefs or values play an important role in influencing the integration of computers in general teaching areas. In a recent review of the literature on teacher attitudes towards computers, Dupagne and Krendl (1992) identified twenty aspects related to teacher's perceptions of computers, the impact of computer use and the impact of personal and learning environment characteristics affecting a teacher's intention to use computers as teaching learning strategies.

Chandra, Bliss and Cox (1988) studied the implementation of computers in secondary schools in the United Kingdom and found organisational constraints within schools were a significant impediment to the diffusion of computers across the curriculum. More recently, Schofield (1995) following a two year study of Whitmore High School, stated "preexisting attitudes and social structures shape the extent to which technology is used as well as the way it is used" (p.94).

Organisational constraints relate to the policies and practices (official and unofficial) that inhibit the implementation of ideas. In a survey of 26 American Principals, Hameyer (1989) noted that there was a degree of scepticism about whether or not computers would enhance learning. Hameyer also found that the financial resources innovative technology might consume concerned many of the Principals.

The impact of the school principal on computer implementation is decisive. Indeed, research has demonstrated that support provided by principals and other administrators consistently predicts successful integration of computers into the instructional process (Becker, 1984; Dupagne & Krendl, 1992; Mahmood & Hirt, 1992).

For some teachers, frequent and systematic use of computers for activities that involve higher order thinking is the norm. In a nationwide study of 608 teachers described as accomplished at integrating computing into their teaching by the Bank Street College of Education (Sheingold & Hadley, 1990: Hadley & Sheingold, 1993), it was found that exemplary practitioners, devoted considerable time and effort to teaching with computers, using computers as multipurpose tools to present more complex material to students and to foster greater independence within the classroom. The study concluded that provided there is enough technology for teachers to have regular access, ample support and time for teachers to learn how to use and plan for computer use and there is a school climate which encourages an experimental approach to teaching, then it is possible for other teachers to gain the expertise and comfort levels demonstrated by exemplary teachers.

The Study

The present study sought information about the existence of incentives and barriers to the integration of computers across the curriculum in Department of School Education (DSE) secondary schools in Western Sydney. Issues identified in the literature as influencing teacher's intentions to use information technology provided a conceptual basis for the study.

A questionnaire was developed for use in selected schools. The literature on cross curricula use of computers, contains many examples of questionnaires (Gardner, Discenza & Dukes, 1993; Kluever, Lam, Hoffman, Green & Swearingen, 1994; Massoud, 1991; Robertson, Calder, Fung, Jones & O'Shea, 1995; Winnans & Brown, 1992; Woodrow, 1991). Selected questions from these questionnaires were chosen and categorised to reflect the broad issues identified in the literature.

The questionnaire was divided into two sections. The first sought information about gender, age, teaching experience, key learning area of teaching, teaching status, computing skill, computer availability and major use of computers. The second section contained questions organised into categories, Computer Anxiety, Self Confidence, Perceived Relevance, Pedagogical Practices, Staff Development, Access to Resources and Policy Formulation. Each question required a response on a five-point likert scale (1 strongly agree to 5 strongly disagree).

Prior to randomly selecting schools, the potential pool of DSE secondary schools was arranged into Comprehensive, Selective and Technology high schools. Six schools (2 each from each category) were then selected. Each school was located on a map to determine if the overall selection reflected the geographical and socioeconomic diversity of Western Sydney. Only then were schools invited to participate. Of the original six, one school (a selective school) declined to participate and it was replaced. The replacement, also chosen at random, maintained the integrity of the diversity of the schools originally chosen.

The Results

Due to the magnitude of the data collected, only relationships between teacher computing skill and intentions to use computers has so far been considered. It was decided to concentrate upon this factor to determine if there were significant differences between teachers consistent with studies by Becker (1994), Honey and Moeller (1990) and Sheingold and Hadley (1990).

Questionnaires were distributed to the 407 teachers in the 6 selected schools and 150 were returned (response rate 36.9%). Teachers were asked to rate their computer skills as a means of identifying levels of expertise within the sample. The results are illustrated in Table 1.

Comp Skill	Frequency	Percent	Cumulative
Low	24	16.0	16.0
Below Ave	26	17.3	33.3
Average	71	47.3	80.7
Above Ave	19	12.7	93.3
High	10	6.7	100.0
TOTAL	150	100.00	

Table 1: Question 6 Rating Teachers' Computer Skill

For each of the categories, data were collapsed into a single measure. To determine the consistency of the category variables, a reliability analysis was completed and Alpha scores (() calculated using SPSS for Windows. Alpha scores of 0.75 or greater were considered to indicate a high correlation between items used to measure the same variable. Data items considered to be unreliable were omitted from the category variable (see Table 2).

Variable	No. of Items	Score	Deleted Items
Computer Anxiety	10	.8167	Nil
Self Confidence	10	.8384	Q.8
Perceived Relevance	10	.8062	Q.7
Pedagogical Practice	15	.8527	Q.1, 2, 4, 6, 7, 10
Staff Development	10	.7554	Q.5, 8
Access to Resources	11	.6861	Q.1, 2, 3, 10
Policy Formulation	15	.7175	Nil

Table 2: Alpha Scores of Variables affecting Teachers' Intentions to Use Computers

To test for an effect of computer skill on teachers' intentions to use computers a series of one way analysis of variance (ANOVA) was used. Significant differences (p2 0.01) were indicated for Computer Anxiety, Self Confidence, Perceived Relevance, Pedagogical Practices and Staff Development (see Table 3).

Post hoc comparisons (Popham & Sirotnik, 1992) using the Newman Keuls technique at the 0.05 level of significance were undertaken to explain the between group variations in Computer Anxiety, Self Confidence, Perceived Relevance, Pedagogical Practices and Staff Development. The results are illustrated in Tables 4 to 8.

The low mean scores shown in Table 4 equate with lower levels of anxiety. The mean scores of the high skill and above average skill groups were not sufficiently different to indicate a between groups difference. This, combined with between group differences for all groups suggests that for anxiety, there may be four rather than five groups within the sample. The existence of multiple between group differences points to anxiety being a very complex variable. Dimensions covered in the survey include, fear of the unknown, an inability to conceptualise uses and above all a desire not to be seen to be inadequate either by peers or students.

Self confidence is a measure of one's interaction with computers. The lower means of the High and Above Average skills groups recorded in Table 5 identifies those group's greater interaction with technology. Again, the mean scores of the high skill and above average skill groups were not sufficiently different to indicate a between groups difference, while multiple between group differences were recorded for all other groups. Woodrow (1991) has argued that anxiety and confidence are two sides of the same coin, a result not at odds with the above. However, Gressard and Loyd (1987) suggest that there is sufficient difference between the variables to conclude that they are indeed separate.

Variable	DF	F Ratio	p≤
Computer Anxiety	4,144	36.2318	0.0001
Self Confidence	4,144	27.7290	0.0001
Perceived Relevance	4,144	7.2703	0.0001
Pedagogical Practice	4,143	10.7703	0.0001
Staff Development	4,142	8.4712	0.0001
Access to Resources	4,141	2.1971	0.0723
Policy Formulation	4,141	0.5556	0.6952

Table 3: ANOVA Results: Computer Skill and Intention to Use Computers

Mean	Skill	High	A. Ave	Ave	B. Ave	Low
15.9000	High	■	■	■	■	■
16.7895	A. Ave		■	■	■	■
22.1127	Ave	*	*	■	■	■
29.2308	B. Ave	*	*	*	■	■
34.7826	Low	*	*	*	*	■

(*) Indicates a between group difference

Table 4: Results of Newman-Keuls Test Computer Skill and Anxiety

Mean	Skill	High	A. Ave	Ave	B. Ave	Low
10.6000	High	■	■	■	■	■
14.0526	A. Ave		■	■	■	■
17.3803	Ave	*	*	■	■	■
22.3462	B. Ave	*	*	*	■	■
26.7826	Low	*	*	*	*	■

(*) Indicates a between group difference

Table 5: Results of Newman-Keuls Test Computer Skill and Self Confidence

Van Lengen (1985) asserted that all teachers were willing to use computers, but that the problem was that many were either infrequent users or they didn't know how to use them. Infrequent users require structured opportunities to practice the requisite skills, while in 1996, those who do not know how to use them have successfully avoided the many basic staff development activities that have run over the years, indicating a need to monitor more closely the impact of staff development.

Mean	Skill	High	A. Ave	Ave	B. Ave	Low
16.7000	High	■	■	■	■	■
18.5263	A. Ave		■	■	■	■
19.0423	Ave			■	■	■
22.6923	B. Ave	*	*	*	■	■
25.0435	Low	*	*	*		■

(*) Indicates a between group difference

Table 6: Results of Newman-Keuls Test Computer Skill and Perceived Relevance

The higher means of the low and below average computer skill teachers and the resulting between group differences, suggests the low and below average skills groups see little if any relevance in using computers. A marked dichotomy appears to exists between 'low tech' and 'high tech' teachers. Given that the questions asked relate to the impact of computers on student learning, it is highly likely that the 'low tech' teachers engage in more traditional practices. As Honey and Moeller (1990) suggest, "low tech" teachers always display negative views towards the use of computers in their classrooms, perceiving computers to be a threat to their control of students and the completion of work. These teachers always have reasons not to use computers.

Mean	Skill	High	A. Ave	Ave	B. Ave	Low
18.9000	High	■	■	■	■	■
19.8947	A. Ave		■	■	■	■
21.0714	Ave			■	■	■
24.0846	B. Ave		*	*	■	■
29.8261	Low	*	*	*	*	■

(*) Indicates a between group difference

Table 7: Results of Newman-Keuls Test Computer Skill and Pedagogical Practices

In relation to teachers' pedagogical practices, the higher means of the low and below average computer skill teachers and the resulting between group differences, suggests that the low and below average computer skills groups do not believe computer use will enhance student learning. Again, a marked dichotomy exists. The questions posed in this category relate to the ease of assimilation of computers into a teacher's teaching style, the ways they organise lessons and the additional tasks required of them in the delivery of those lessons. For this group, it appears as if other approaches to teaching have more to offer or that less innovative approaches are within teachers' comfort zones.

The very high mean of the high computer skill group suggests that teachers in this group perceive little scope for current staff development practices to improve their computer skills. However, for other teachers, there remains a need (perceived or otherwise). The basis of this need requires additional analysis with respect to other variables.

Conclusion

The initial analysis of the data suggests considerable fluctuation in the way teachers feel about computers. These feelings manifest themselves within the skill base of teachers which in turn influences teacher intentions to use computers as tools for learning and discovery. The analysis has identified a pool of highly skilled computer using teachers within schools who could act as catalysts for the creation of a computer culture which could serve to promote motivation, cooperation and collaboration among faculty as a means of altering the ways teachers feel about computers.

Not surprisingly, most of this group of teachers are drawn from Mathematics and Technology faculties, which Wellington (1990) saw as a subtle obstacle to the spread of computers across the curriculum. If this group is to succeed it has to be aware that the appropriate culture is based on the use of computers for learning rather than learning about computers and computing. If the group is to be successful, they too will have to alter their practices to provide the role models Collis (1998) believes are missing.

The fact that there is diversity in teachers' computer skills simply serves to highlight the multiplicity of the problem faced by advocates of integrating computers across the curriculum. If there is to be any long term solution, then sufficient time must be provided for teachers to learn how to use technology in their teaching and to plan for its use.

Mean	**Skill**	High	A. Ave	Ave	B. Ave	Low
27.7000	High	■	■	■	■	■
20.7895	A. Ave	*	■	■	■	■
18.3188	Ave	*		■	■	■
16.3462	B. Ave	*	*		■	■
17.9565	Low	*				■

(*) Indicates a between group difference

Table 8: Results of Newman-Keuls Test Computer Skill and Staff Development

Bibliography

Adams, A. (1992). Looking forward by looking backward: Computers in education. In C. Bigum and W. Green (eds.) *Understanding the new information technologies in education. A resource for teachers*. Geelong, Vic: Centre for Information Technologies in Education, Deakin University, 163-202.

Becker, H. J. (1994). How Exemplary computer-using teachers differ from other teachers: Implications for realising the potential of computers in schools. *Journal of Research in Computing in Education, 26* (3), 291-321.

Bigum, C. (1990). Computers and the curriculum: The Australian experience. *Journal of Curriculum Studies, 22* (1), 63-67.

Board of Studies. (1994). *Computing studies. 3 unit (additional).* Sydney: Author.

Borg, W. R., & Gall, M. D. (1989). *Educational research* (5th Ed.). New York: Longman.

Bork, A. (1991). Computers and educational systems. *Australian Educational Computing, 6* (2), 34-37.

Burns, P. K., & Bozeman, W. C. (1981). Computer assisted instruction and mathematics achievement; Is there a relationship? *Educational Technology, 21*, 32-37.

Chandra, P., Bliss, J., & Cox, M. (1988). Introducing computers into school-management issues. *Computers in Education, 12*, 57-61.

Collis, B. (1988). Research windows. *The Computing Teacher, 16* (1), 6-7.

Dupagne, M., & Krendl, K. A. (1992). Teachers' attitudes towards computers: A review of the literature. *Journal of Research on Computing in Education, 24* (3), 420-429.

Gardner, D. G., Discenza, R., & Dukes, R. L. (1993). The measurement of computer attitudes: An empirical comparison of available scales. *Journal of Educational Computing Research, 9* (4), 487-507.

Gressard, C. P., & Loyd, B. H. (1987). An investigation of the effects of math anxiety and sex on computer attitudes. *School Science Mathematics, 87*, 125-135.

Hadley, M., & Sheingold, K. (1993). Commonalities and distinctive patterns in teachers' integration of computers. *American Journal of Education, 101*, 281-315.

Hameyer, U. (1989). Computers in the classroom: A school profile and what U.S. researchers discovered. *Computer Education, 61*, 7-11.

Hodson, D. (1990). Computer-based education in New Zealand: A time of transition and uncertainty. *Journal of Curriculum Studies, 22* (1), 67-72.

Honey, M., & Moeller, B. (1990). *Teachers' beliefs and technology integration: Different values, different understanding*. New York: Center for Technology in Education

Khalilli, A., & Shashanni, L. (1994). The effectiveness of computer applications: A meta-analysis. *Journal of Research on Computing in Education, 27* (1), 48-61.

Kluever, R. C., Lam, A. C. M., Hoffman, E. R., Green, K. E., & Swearingen, D. L. (1994). The computer attitude scale: Assessing changes in teachers' attitudes towards computers. *Journal of Educational Computing Research, 11* (3), 251-261.

Kulik, J. A. (1985). *Consistencies in findings on computer-based education*. Paper presented at the annual meeting of the American Educational Research Association, San Fancisco, CA. (ERIC ED 263 880)

Kulik, J. A., Bangert R., & Williams, G. (1983). Effects of computer-based teaching on secondary students. *Journal of Educational Psychology, 75*, 19-26.

Liao, Y. C., & Bright, G. W. (1991). Effects of computer programming on cognitive outcomes: A meta-analysis. *Journal of Educational Computing Research, 7* (3), 251-268.

Lockard, J., Abrams, P. D., & Many, W. A. (1994). *Microcomputers for twenty-first century educators*. (3rd ed). New York: Harper Collins Publishers Inc.

Mahmood, M. A. & Hirt, S. A. (1992). *Evaluating a technology integration causal model for the K-12 public school curriculum: A lisrel analysis*. (ERIC ED 346 847)

Massoud, S. L. (1991). Computer attitudes and computer knowledge of adult students. *Journal of Educational Computing Research, 7* (3), 269-291.

Morton, A. D. (1994). The race to shape the future. Promoting the diffusion of information technology in the curriculum. In S. Wawrzyniak & L. Samootin (eds.) *Ask me why?* Proceedings of the 10th Annual New South Wales Computers in Education Conference. Macquarie University, 207-214.

Pelgrum, W. J., & Plomp, T. (1991). *The use of computers in education worldwide*. Oxford: Pergamon Press.

Popham, W. J., & Sirotnik, K. A. (1992). *Understanding statistics in education*. Itasca, Illinois: F. E. Peacock Publishers, Inc.

Robertson, I. S., Calder, J., Fung, P., Jones, A., & O'Shea, T. (1995). Computer attitudes in an english secondary school. *Computers in Education, 22* (2), 73-81.

Roblyer, M. D., Castine, W. H., & King, F. J. (1988). *Assessing the impact of computer-based instruction: A review of recent research*. Binghamton, NY: Haworth.

Schofield, J. W. (1995). *Computers and classroom culture*. Cambridge: Cambridge University Press.

Sheingold, K., & Hadley, M. (1990). *Accomplished teachers: Integrating computers into the classroom*. New York: Center for Technology in Education, Bank Street College of Education.

Van Lengen, C. (1985). Will we effectively use computers as a tool in education? *Educational Technology, 25*, 47-48.

Wellington, J. J. (1990). The impact of I T on the school curriculum: Downwards, sideways, backwards and forwards. *Journal of Curriculum Studies, 22* (1), 56-63.

Winnans, C., & Brown, D. S. (1992). Some factors affecting elementary teachers' use of the computer. *Computers in Education, 18* (4), 301-309.

Woodrow, J. (1991). A comparison of four computer attitude scales. *Journal of Educational Computing Research, 7* (2), 165-187.

Yakub, M. (1994). *Integrating computers across the curriculum: Is it happening? A case study*. Unpublished M. Ed coursework project, University of Western Sydney, Nepean, Penrith, N.S.W.

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An investigation of the nature and form of interactions in Live Interactive Television

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Live Interactive Television is a popular medium for delivering educational programs to students in remote areas in Australia. The medium uses television to deliver a live one-way video signal and standard telephony to provide two-way audio communication between the instructor and students. Much of the potential of this medium is derived from the interactivity between the instructor and students that it supports. Because all interactions are ultimately student-initiated, the medium has a number of unique and characteristic features. This paper describes a study that sought to identify different kinds of interactivity employed by instructors and students and to investigate the impact and role of these interactions on the subsequent instructional activities.

Live interactive television (LIT) is commonly used in Western Australia and other states in Australia, in the delivery of educational programs to school students in remote and rural areas. This technology appears to provide a cost-effective means to deliver educational programs in a variety of formats across vast distances. LIT involves a one-way video link between the teacher and student through conventional television delivery and two-way audio between teacher and students brought about through standard telephone communications.

The popular use of LIT as a delivery medium among local institutions stems from a variety of reasons. It is a relatively inexpensive delivery medium and uses technologies that are widely available among rural areas (Oliver & Grant, 1994). A key component in the choice of this technology is the interactivity that it supports between the instructor and students and the ensuing educational advantages to be derived. This paper describes a study that was undertaken to investigate the form and nature of the interactions that are evident in LIT programs. The purpose of this investigation was to establish the impact of the interactivity provided by the technology in enhancing the quality and form of the instructional programs. The study sought to identify the means by which instructors use the interactive capabilities of the technology and the impact and role of the interactions within the instructional sequences.

Live Interactive Television

Numerous studies have previously reported on the use of LIT in distance and open education programs across a variety of subjects and education levels (eg. Beare, 1989; Dillon, Hengst & Zoller, 1991; Nahl, 1993; Simpson, Pugh & Parchman, 1993; Oliver & Grant, 1995). From these reports, it is evident that many differences exist in the instructional formats being employed and the level of interactivity supported by the technologies has a significant influence on this. Descriptions of research among telecourses with a continuous audio link indicate that audio interactions can be used extensively in delivering and elaborating on lesson content. Kirby and Boak (1989) performed a content analysis of the teacher-student discourse in such a setting. Their results revealed that teachers initiated the vast majority of the interactions and the majority of the discourse was didactic instruction and explanation on the part of the teacher. Questions were used to invoke responses in much the same way as teachers use questioning in face-to-face teaching. The questions tended to be narrow and convergent requiring little reflection or consideration on the part of the learners. Furthermore very little communication was observed between students and very little student-initiated discourse occurred. This description of telecourse learning environments is supported by Nahl (1993) and Pugliese (1994) who report a frequent reluctance on the part of many learners to actively use the technology to facilitate interactions between learners and instructors.

A common alternative to a full audioconferencing capability in teleteaching is the use of a telephone communication link initiated by the student. This alternative significantly reduces the cost and equipment infrastructure needed to support the teleteaching program. The system enables students to phone the instructor during a lesson usually on a toll-free number. Instructors provide opportunities for students to make the link during the lesson and when students do so, the teacher-student discourse contributes to the lesson delivery. Many studies report that optimal use is frequently not made of the interactive capabilities of teleteaching technologies. In such settings, students often express dissatisfaction with the lack of direct communication with their instructors (eg. McCleary and Egan, 1989; Pirrong & Lathen, 1990).

Interactivity

The pursuit of interactivity has become a significant goal in the design and provision of distance education and open learning programs. Modern technologies have the potential to overcome the isolation of distance and open learning through the facility of communication lines and learning resources that are responsive to an individual's needs. Innovative applications of such technologies as computer-mediated communications, multimedia and television can now all be used to provide dynamic and customised learning environments. In this context, any learning material or learning environment that provides the learner with more than a passive learning environment is usually said to be *interactive*.

The interactivity that is frequently sought in distance education and open learning is that associated with conversations between the teacher and the student. Whereas conventional interactions between teachers and remote students tend to be asynchronous in nature, classroom conversations tend to be synchronous and in real-time. This is the sort of interactivity afforded by such technologies as teleteaching and LIT. Apart from offering support to teacher-student interactions, these technologies also provide scope to include the two other vital forms of interaction into distance education, learner-learner and learner-content (Moore, 1989; Mason, 1994).

Juler (1990) describes interactivity as a principal aspect of conventional face-to-face teaching that has traditionally been absent from open learning and distance education environments The potential of new technologies to overcome this problem has been met with high levels of enthusiasm by instructional designers and education providers. Interactivity provides a means to motivate and stimulate learners and provides the means for instructors to cause students to consider and reflect on the content and process of learning. Few would dispute the advantages to be derived from the inclusion of interactive elements in teaching and learning and the implicit assumption that interactive environments are superior to others appears to drive much of the activity and development in this field.

Many other technologies, for example, multimedia and computer mediated telecommunications, provide a form of one-to-one communication and conversation between the teacher and student. Previous research has identified the importance of this teacher-student dialogue if the maximum learning potential of the interaction is to be derived (eg. Laurillard, 1993). Many forms of technology used in distance and open education make the provision of one-to-one communication and interaction extremely difficult to achieve as a single teacher often needs to communicate with large numbers of external students. Strategies that have been used to overcome this problem include a range of 'off-air' communication technologies including facsimile machines, e-mail and telephone (Gunawardena, 1990).

Investigating instructional strategies and interactions

Several writers have performed an analysis of the forms of instructional strategies and interactions that are supported by the technologies in LIT and similar settings (eg. Dillon, Hengst & Zoller, 1991).

In an analysis of a series of programs broadcast by the Oklahoma Televised Instruction System, Dillon et al. (1991) found that the majority of instructors favoured a form of teaching which incorporated very little interactivity into the instructional program.

An important question, frequently asked by researchers, is whether the attributes of effective face-to-face teaching are the same as what constitutes effective interactive television teaching? Gehlauf, Shatz & Frye (1991) found that instructors tended to use only a narrow range of instructional strategies and these tended to be based on their conventional teaching practices. There is an acceptance among many researchers that there are new skills that must be developed to effectively teach through interactive television. Chung (1991) provides a detailed description of student perceptions of important attributes of telecourses and a large number of the factors described by the students as essential relate directly to instructional strategies employed by the instructors.

Our previous research has demonstrated that LIT is not necessarily inferior to face-to-face teaching despite the reduced levels of teacher-student discourse that can be achieved (eg. McLoughlin, 1994). In fact minimal amounts of teacher-student interaction are frequently observed in many face-to-face teaching settings. The instructional design processes that accompany conventional teaching planning appear to make little use of interactions with individual students as a means to develop lesson content. Despite the many different forms and functions for interactions to take, many teacher-student interactions occur for reasons other than providing individualised feedback to aid individual learners (Cazden, 1988).

Research Aims

The purpose of this study was to investigate LIT teaching strategies with the view to determining the ways instructors used the interactive capabilities of the technology in their lesson delivery. Initially we were interested in examining the ways in which different instructors employed interactions in order to establish patterns of use and to quantify instructors' preferred forms of interactivity. Also of interest was the impact of the interactions created by the instructors on the learning environment. The study sought to determine:

- the form, nature and purpose of the interactions in each instructional setting,
- the level of student response, and
- the impact of different interactive activities on lesson development and delivery,

through a detailed analysis of a range of local LIT teaching episodes and programs.

Methodology

The investigation of interactions in LIT teaching and learning was carried out by analysis of teacher-student discourse across a range of LIT courses and programs. Videotapes were obtained of 5 LIT courses representative of programming in Western Australia. The courses included school, vocational and university delivered programs. Five consecutive lessons from each of the courses were observed and transcriptions made of the teaching-learning interactions. A content analysis was conducted across each of the programs to provide information to determine the nature and forms of interactions used in the instructional process.

Framework for analysis of interactions

This investigation was the study of the discourse of interaction and communication between participants was object of focal attention, consistent with the conversational framework of Laurillard (1993). Consideration was given to procedures of classroom observation which have been the subject of debate and research (Flanders, 1970; Cazden, 1988). Interaction analysis describes and categorises various aspects of instructional practices that take place between teachers and students in contexts where there is a teaching-learning transaction. Such analyses are typically guided by an observation instrument consisting of a list of predetermined relevant categories of behaviours that observers look for and record. One criticism made of such schemes is that they consist of a set of predetermined categories that seriously limits and restricts the observers perceptions. In other words, using such a observation scheme would produce tunnel vision, because the observer would tend to see only behaviours that coincided with the observation scheme.

Type of Interaction	Description	Example
social	teacher/student talk establishing and developing rapport	T: Hello Mandy, how are you? S: Very well thank you. T: Great to hear from you, what are you going to do for us?
procedural	teacher/student dialogue involving information exchange on course requirements and procedures	S: Mr Gray, can you tell me how many pages you want us to write? T: I'm looking for about 2 pages in total. S: Can we use a topic of our own choice?
expository	student or teacher demonstrating knowledge or skill in response to a direct request from another.	T: Can any one tell me the correct name for this animal? S: Is it raptorus maximus? T: No, but it is from the raptorus family.
explanatory	teacher using student responses to explain knowledge and develop content.	T: This is how we place our fingers to play the note A. Can you play an A for me Mandy? S: Mandy plays an A. T: That was good but you have to blow a bit harder and make sure your fingers are covering the holes completely.
cognitive	teacher providing constructive feedback to a student response causing the student to reflect and to consider an alternative perspective/reality.	T: Can you tell me what you think was the main reason for his actions? S: He was angry and wanted to get even. T: But was that all? What about his wish to improve his position and standing? S: I suppose but he did but I though that he would done it differently.

Table 1. A Framework for investigating interactions in Live Interactive Television

A more recent scheme developed by Henri (1992), based on the findings of cognitive psychology, aims to delve deeper into the different levels of meaning in messages in order to study the complexity of the learning process. Content analysis, as this approach is known, is an analytical approach which highlights the critical dimensions of the learning process: participative , interactive , social, cognitive and metacognitive. Content analysis was chosen for the present study because of its potential to provide a multilevel understanding of the learning process. As the original framework was developed by Henri (1992) for computer mediated communication, a modified version of the approach was used to create a framework for our investigation of LIT interactions. The need for students to initiate interactions in LIT has the potential to influences significantly the type and form of interactions which occur. An initial analysis of the videotaped lessons led to the identification of 5 types of communicative interactions evident in LIT teaching environments. Table 1 describes each of these interactions and provides an example and description of each.

Data Gathering

The videotape transcriptions for each of the courses were analysed using the above framework with each teacher-student communication being considered and classified. Other details of each interaction were also noted including the number of exchanges involved and duration of the exchanges. Most interactions were clearly of one form and were classified with little difficulty. Some interactions, however, were of a form that combined elements from two dimensions. For example, several exchanges involved a social and explanatory form of communication. In such cases, it was possible to describe and classify two interactions in the one communication episode.

Results

The following section describes the teaching programs that were investigated and the forms of the interaction that were evident in the 5 courses that were reviewed.

Program 1. Playing the Recorder This series of lessons involved a teacher using the television to teach remote students to play the recorder. The course was televised in a narrowcast format to primary school children in rural areas studying by correspondence. Students were invited to participate in the course which acted as an enrichment adjunct to the conventional program. Students electing to join in the course were supplied with course notes and music samples and given a program of instruction and activity to follow. The television programs acted as support for the overall course. Each lesson involved the teacher demonstrating the fingering and actions associated with playing notes on the recorder and playing small tunes. Students were invited to call through to play their own tunes to show their skills and to demonstrate their progress.

All interactions in this series of lessons involved a social dimension as well as some other purpose. The teacher took the time to chat with each student who called, many of whom were known previously to him. The majority of the interactions also served an expository purpose with a child playing a piece on the recorder. In almost all instances, the feedback was positive and general. There was minimal use made of the students' playing to provide feedback that caused reflection or that caused some change in performance or activity. There were a number of instances when the feedback was used to make a general and explanatory point to all students. There were no procedural interactions. The television instruction was designed to supplement a correspondence course framework . Procedural matters were dealt with through independent interactions between the students and their course tutors.

Program 2. Science Matters Science Matters was a weekly television program broadcast by a local university to a public viewing audience with the intention of providing a series of interesting science topics for general viewing with the support of a talkback feature to extend the likely learning outcomes able to be achieved. A range of topics was chosen for the course. Each program was anchored by a science teacher and involved a studio interview/discussion with a relevant expert with viewers encouraged to call and to ask questions or to answer questions posed by the presenters.

This series of programs proved to be quite interactive. Each program typically received 6 to 8 calls from viewers. There were few social interactions among these. This was brought about by the open nature of the course delivery and the change in expert from program to program. There were only two social interactions observed and these occurred when viewers identified themselves as having called previously and greeted the presenter in a manner that led to a social exchange. The explanatory interactions in the program were brought about through the presenter and expert discussing aspects of the topic. The presenter frequently asked questions and sought clarification in much the same way as face-to-face students do in normal classrooms. At the same time, the expert often spoke to the presenter and sought feedback as an instructional strategy.

Program 3. Computer Applications Computer Applications was a series of programs involving instruction and demonstration in the use of a personal computer and applications software. The instruction was well suited to television broadcast with screen displays and instructions and outcomes clearly presented on the TV monitor. The series of programs was aimed at providing elementary computer instruction for general viewing and sought to take computer novices with computer hardware and software along the track to computer self-sufficiency. An interactive element was built into the course to enable viewers to call in if there were queries and questions that arose from the instruction being given.

Viewers were frequently reminded of the talkback facility and encouraged to call in with questions. The presenter tended to follow a planned course of instruction and provided little opportunity for student participation other than direct questions. Whereas in other settings, the presenters planned and sought interactions through direct questions, offering incentives and appropriate presentation of content, this course offered a general invitation to callers but did not have an established place for interactions in the lesson design. As a consequence, few interactions resulted and those that did were mainly of an expository nature, being direct questions from students requiring specific answers.

Program 4. Women in Australian Society This course was a 12 week series of lessons narrowcast to an enrolled viewing audience in local access points in towns in rural Western Australia. Students enrolled in this course and received course materials and information supplemented by the interactive television broadcast. The course was designed as a short course for rural students and delivered through a vocational education program. The presenter was aware of the enrolled students and received assignments and work samples from them throughout the course.

The nature of the lessons from week to week was a discussion of relevant topics inviting responses from the viewers mingled with feedback on materials and work submitted by the students as part of the course requirements. The interactive component within this series of lessons formed a significant part of the teaching and learning. The instructor relied heavily on discussing issues and problems with the students as a means of presenting the course content and causing students to reflect and consider. The lessons were planned with interactions as a critical teaching element. This was a course in which cognitive interactions were evident. The presenter used the cognitive interactions to draw information from students and to cause them to consider responses and to reflect on their own impressions and attitudes.

Program 5. Childcare The Childcare course was a 15 week course delivered through correspondence mode to rural students as part of an award course. The television component was a supplement to the correspondence mode and was received by the rural students at local access points. The interactive element provided a means for student-teacher communication and was planned into each lesson by the instructor.

The form of dialogue that was encouraged saw many of the interactions being of an explanatory form where the teacher encouraged other students to help present course content. These forms of interactions tended to involve many short exchanges between the student and instructor. In this way a considerable part of the teaching in any session was actually as a result of student explanation with the instructor guiding. At times, these explanations became cognitive interactions as the instructor probed and questioned students to further understanding.

This set of lessons revealed a large number of procedural interactions. Students frequently asked questions relating to course requirements when they called. These interactions tended to be handled quickly by the instructor who then took the opportunity to establish a dialogue with the student resulting in forms of exchanges representing other forms of interactivity. Frequently a procedural interaction with a student was followed immediately by an explanatory or expository interaction.

Table 2 shows a comparison of the relative frequency of the different forms of interaction observed across the 5 teaching programs.

Discussion

Interesting patterns were revealed in the analysis of the different forms of interaction used in teaching episodes across the 5 courses using. The most common form of interaction used in these settings was expository and involved answers to direct question, either teacher or student initiated. Other common interactions that were observed were social and explanatory. Both of these were seen to serve useful purposes and were used frequently by the teachers. In one setting, there was a high proportion of procedural interactivity while most other courses demonstrated very little of this. It was interesting but not unexpected to find that low levels of cognitive interactivity were prevalent in most teaching settings. This is interesting because one of the main reasons given to support the need for teacher-student interactivity in distance learning is based on the contention that interactions are able to enhance cognition and higher order learning. In LIT, the use of interactions for this purpose is not strongly evident.

The nature of the course and the viewing audience appeared to have a large impact on the forms of interactivity evident in the teaching episodes. In courses where there were enrolled students, for example Childcare and Women in Australian Society, the instructors tended to use the interactions as teaching instruments. Explanatory and cognitive interactions were quite prevalent. In situations where the audience was open and the instruction less focused on a course, for example Computer Applications and Science Matters, the interactions were expository in the main and less linked to a planned instructional program.

	social	procedural	expository	explanatory	cognitive
Playing the Recorder	56%	0%	38%	6%	0%
Science Matters	4%	0%	70%	26%	0%
Computer Applications	0%	10%	71%	19%	0%
Women in Australian Society	32%	0%	0%	29%	39%
Childcare	15%	39%	3%	33%	10%
Average	21%	10%	36%	23%	10%

Table 2. Relative frequency of observed interactions across 5 programs

Students were observed to play a major role in the interactive episodes in all the lessons that were observed. In the first instance, the students initiated the interaction and did so with some specific intent. This tends to be quite different from normal teacher-student interactions where the teacher is usually the initiator of the interaction. When the teacher initiates the dialogue, the student usually responds directly to either a question or an imperative. In LIT settings, it is the teacher who initially becomes the respondent. It is only after the student's request has been answered that the teacher can perhaps initiate some further dialogue or communication. In this study, it was clear that many instructors chose not to further the communication after the initial dialogue. This resulted in a large number of exchanges being observed that tended to be short in duration and involving low levels of cognitive activity on the part of teacher and student. It was evident however that cognitive interactions are possible and relatively easy to implement through appropriate instructor-led communication and dialogue.

Summary and Conclusions

Live Interactive Television is a popular medium among many rural students as an adjunct and support for open learning courses and programs. Despite limitations in the interactivity it can support, it appears that the interactions that are achieved in instructional applications can serve very useful purposes. Our study has found that instructors tend to use the interactive elements, more to create a supportive and stimulating learning environment than for instructional support. Observations of the forms of instructor-student dialogue revealed that the most frequently employed were those of an informative and discursive nature where either party gave information to the other in relatively short exchanges.

It would appear that instructors may be under-utilising the potential of LIT as a medium capable of supporting cognitive interactions. Most instructors appear to use the interactive capability in a secondary capacity in their teaching and learning. Using the interactions for other than short exchanges in LIT has its inherent difficulties. As stated earlier, the instructor must wait for the student to call before any form of dialogue is possible. Once a call has been received, the instructor has to take control of the communication in order to initiate interactions of a higher cognitive order than might normally occur. This requires a degree of skill and experience on the part of the instructor and would appear to be a skill that might take some time to develop. At the same time, the instructor needs to be able to incorporate interactive elements into the planned instructional program. In this regard, LIT appears to require particular instructional design considerations that could be explicitly stated as a guide for intending instructors.

It is likely that LIT will continue to be used in the local context as a delivery medium for a range of open learning programs. The outcomes from this research have demonstrated possible shortcomings in current instructional design for this medium. Most instructors appear to make only limited use of the interactive capabilities and there appears to be considerable potential to extend learning outcomes. In our future research we plan to investigate strategies that can be employed in teaching with LIT to increase the level of cognitive interactions while maintaining an environment that is supportive and stimulating for all participants.

References

Beare, L. (1989). The comparative effectiveness of videotape, audiotape and telelecture in delivering continuing teacher education. *The American Journal of Distance Education, 3*(2), 57-66.

Cazden, C. (1988). *Classroom Discourse.* Portsmouth: Heinemann.

Chung, J. (1991). Televised teaching effectiveness: two case studies. *Educational Technology, January*, 41-47.

Dillon, C., Hengst, H., & Zoller, D. (1991). Instructional strategies and students involvement in distance education: A case study of the Oklahoma Televised Instruction System. *Journal of Distance Education, 6*(1), 28-41.

Flanders, N. (1970). *Analysing teaching behaviour.* New York: Addison Wesley.

Gehlauf, D., Shatz, M., & Frye, T. (1991). Faculty perceptions of interactive television instructional strategies: Implications for training. *The American Journal of Distance Education, 5*(3), 20-28.

Gunawardena, C. (1990). Integrating telecommunication systems to reach distant learners. *The American Journal of Distance Education, 4*(3).

Henri, F. (1992). Computer conferencing and content analysis. In *Collaborative learning through computer conferencing*(pp 117-136). Berlin: Springer-Verlag.

Henri, F., & Parer, M. (1993). Computer conferencing and content analysis. In T. Nunan (Ed.), *Distance Education Futures*, . Adelaide: University of South Australia.

Herrington, J. (1993). Television in Education. In J. Herrington (Eds.), *Using Television and Videoconferencing* (pp. 1-10). Perth: WADEC.

Juler, P. (1990). Promoting interaction: maintaining independence: swallowing the mixture. *Open Learning, 5*(2), 24-33.

Kirby, D., & Boak, C. (1989). Investigating instructional approaches in audio-teleconferencing classes. *Journal of Distance Education, 4*(1), 5-19.

Laurillard, D. (1993). Balancing the media. *Journal of Educational Television, 19*(2), 81-93.

Mason, R. (1994). *Using communications media in open and flexible learning*. London: Kogan Page.

McCleary, I., & Egan, M. (1989). Program design and evaluation: two-way interactive television. *The American Journal of Distance Education, 3*(1), 50-60.

McLoughlin, C. (1994). *An evaluation of the technologies and services of the TAFE Media Network.* Perth, WA: Curriculum and Customised Training Network.

McLoughlin, C. & Oliver, R. (1995). Analysing interactions in technology supported learning environments. In R. Oliver & M. Wild (Eds.), Learning without limits, 2 (pp. 49-62). Perth, Western Australia: ECAWA.

Moore, M. (1989). Editorial: Three types of interaction. *The American Journal of Distance Education, 3*(2), 1-7.

Nahl, D. (1993). Communication dynamics of a live, interactive television system for distance education. *Journal of Education for Library and Information Science, 34*(3), 200-217.

Oliver, R. & Grant, M. (1994). *Distance education technologies: A review of instructional technologies for distance education and open learning.* Perth, WA: Intech Innovations.

Oliver, R. & Grant, M. (1995) Interactive Broadcast Television: The Impact Of Interactions On Programme Presentations. *Journal of Educational Television., 21*(4), 37-50.

Pirrong, G., & Lathen, W. (1990). The use of interactive television in business. *Educational Technology, May*, 49-54.

Pugliese, R. (1994). Telecourse persistence and psychological variables. *The American Journal of Distance Education, 8*(3), 22-40.

Simpson, H., Pugh, H., & Parchman, S. (1993). Empirical comparison of alternative instructional TV technologies. *Distance Education, 14*(1).

Approaches to research in a digital environment — Who are the new researchers?

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The research process in all its different configurations — assignments, independent work requirements — has been a constant feature of the curriculum in primary and secondary schools for many years. The purpose of this process has traditionally been to develop student research skills and to enhance their knowledge within a particular area; although it would have to be admitted that it has been used by many as a time filler rather than a teaching strategy directed towards specific learning outcomes.

Academics have devised numerous configurations of this research process (Marland, 1981; Irving, 1982; Kulthau, 1985; Ministry of Education, Victoria, 1989; Gawith, 1988; Wilson, 1989). However the essential components of the process are identified in the literature as: pre-research, location of resources, selection of resources, recording relevant information, analysing the information, synthesising the information, presenting the results in an appropriate format and evaluating the result and the process.

The Information Process diagram devised by the Australian School Library Association in conjunction with the Curriculum Corporation places this process within the context of generic learning skills and is a useful improvement on many of the other models.

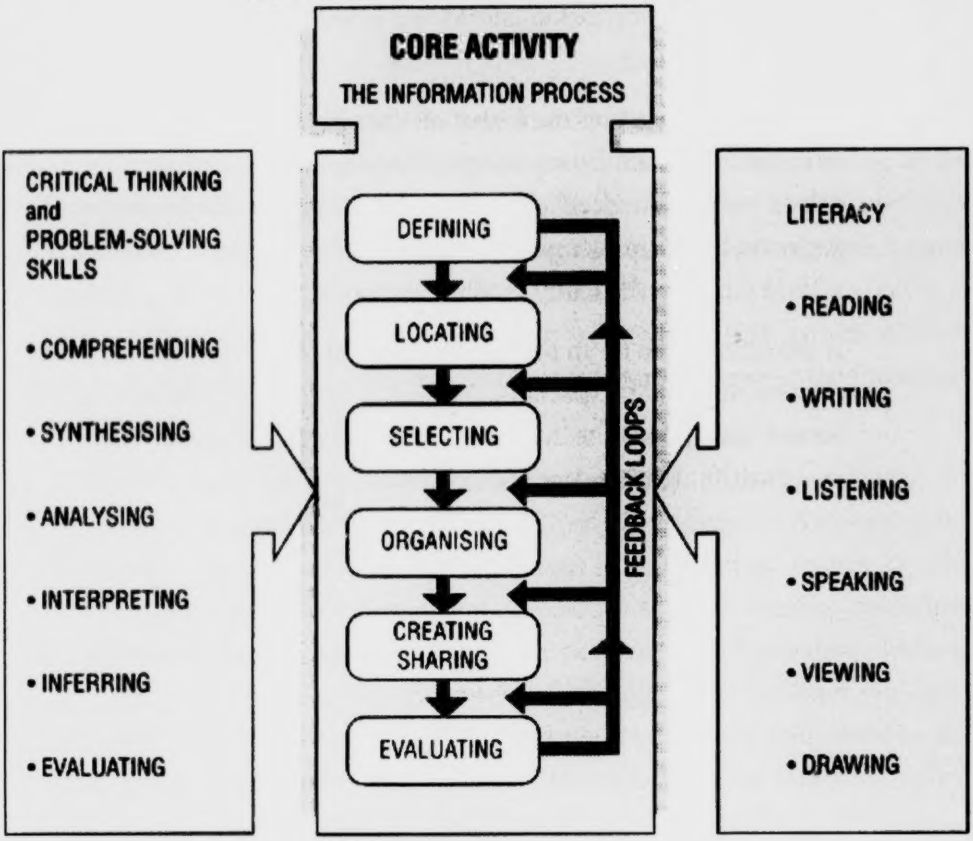
The resource bank which students have used to support research tasks have traditionally relied very heavily on print materials, particularly books and journals. These resources have generally been accessed via school or local libraries. Whilst other sources like video, maps and people have also been valued, print based sources have been the predominate resource format. Traditional research tools like abstracts and indexes have been integral to the efficient location of relevant material.

Research in a digital environment

The advent of the digital information era has challenged and changed many of the traditional research sources, tools, practices and the premises on which they operate. Though it must be said at the outset that the research process as identified in the information process diagram is intrinsically the same. It is still about critical thinking, problem solving and communicating. The diverse range of new information and communication technologies has provided new information sources, hitherto inaccessible. These technologies have provided different ways of accessing that information as well as different ways of organising and presenting work.

The digital information environment is dynamic. Multimedia sources combine several media such as text, graphics, animation, audio and video in an integrated format which is accessed by computer. Multimedia is being heralded as one of the most important influences on schooling for the next millennium. The Internet, in particular the World Wide Web and CD Rom programs as well as other disk based packages are already having an impact on curriculum design, teaching and learning strategies and activities, library collections and the physical infrastructure of schools.

Appendix 1: The Information Process


CORE ACTIVITY
THE INFORMATION PROCESS
CRITICAL THINKING and PROBLEM-SOLVING SKILLS
• COMPREHENDING
• SYNTHESISING
• ANALYSING
• INTERPRETING
• INFERRING
• EVALUATING
DEFINING
LOCATING
SELECTING
ORGANISING
CREATING SHARING
EVALUATING
FEEDBACK LOOPS
LITERACY
• READING
• WRITING
• LISTENING
• SPEAKING
• VIEWING
• DRAWING

Multimedia resources provide access to vast quantities of information in a form that is often more easily retrieved. The CD Rom format for example, can provide an active, in depth reference source on specialised topics or themes. Its features of accessibility, portability and effective storage supplants several weighty tomes on the same topic. The application of the CD ranges from the storage of complex definitive static databases as found in Year Books, dictionaries and encyclopaedias to highly interactive investigative processes used for teaching surgical techniques and fields limited only by one's imagination.

So too, the Internet is already offering significant opportunities for the enhancement of student learning. Students are communicating via email with their peers from around the world. The Global penpal and Art experiences are those which can breathe new life into the concept of writing for communication and ideas sharing. The cultural breadth encouraged through these exchanges do much to allow our students to understand the differences and similarities of people wherever they are. Students are taking part in global or regionally based collaborative research projects. They can go on Internet hunts or get information on the latest film reviews from across the globe. They are visiting online exhibitions, gathering material and images from museums, libraries and databases and importantly they are sharing their ideas and work through electronic publishing.

Negroponte identified significant advantages of digital information in the form of email over voice or snail mail communication. "The true advantage of electronic mail is the ability to process the information you get. You can forward pieces. You can use sections of incoming messages in your outgoing communications. You can store it and retrieve it at will. In short, it has all the advantages of being digital." (Shulman, 1996) Further, electronic communication breaks down the barriers of time, location and social standing between people. Intellectual hierarchies, once a barrier to learning and the exchange of ideas are being dissolved by an overpowering sense of curiosity generated by a digital landscape of instant information. Scientists have always sought to exchange information with other research colleagues. This was done most often via printed journals and conference presentations. Email provides a more direct and immediate opportunity for discourse not only with colleagues but with teachers, schools students or members of community groups thus enriching the exchange and learning of all.

The tools and resources on the Internet offer the opportunity for interaction in a manner and variety never before experienced. The Collaboratory for Research on Electronic Work *(http://www.crew.umich.edu/AboutCREW.html)* investigates how new technologies enable new ways of organising work. It is an example of what it studies: "a Collaboratory," a distributed organisation made possible by new technologies." From a range of locations CREW members share common facilities that support group work, distributed in time or place but which allow them to conduct joint research. Their contribution to the collaboratory approach is via a mixture of laboratory studies, field observation and engagement in design.of new systems and work arrangements.

Schools and Research

Similar approaches incorporating students and schools in the generation of high quality research data are now emerging in the K-12 sector. Relatively low cost access to the Internet, information systems and new technologies place students at the front line of educational opportunity, research and involvement; in many cases they are significantly ahead of industry, commerce and their teachers. The following examples illustrate where we are placed on the continuum of innovation and learning and the exciting challenges we face as educators.

In April 1996 ANZSES, the Australian and New Zealand Scientific Exploration Society, working in partnership with the DSE and private enterprise, conducted a scientific research expedition for senior secondary students to a remote part of the Snowy river. The expedition focus was on small mammal and flora research, recording observations using digital cameras, notebook computers and experimenting with satellite communication links to tertiary institutes and websites. The students were able to be engaged in primary scientific research , under the supervision of scientists and Natural Resources and the Environment(NRE) rangers trialing and evaluating the very latest technologies, safe in the knowledge that their 'satellite in a suitcase' link provided their true global position for all to see. The students were able to locate and identify new species, accepting and rejecting hypotheses and establishing permanent record in photographic and digital form. Their work has been recorded and presented in Photo-CD form.

Research activities of this type stimulate enormous interest in 'what is possible' under difficult and challenging conditions; testing not only the suitability of technology but the practicality of using students for species research. ANZSES and the Department of Natural Resources and the Environment will gain valuable information about this type of research which may then be applied to alpine and coastal parks and popular environmentally sensitive locations such as the Grampians, Wilsons Promontory and the Little Desert.

The Internet and other digital technologies are providing children with both the media and mechanisms to explore, investigate and replicate studies beyond traditional geographic boundaries. Email, closed discussion groups and Internet chat are no longer the province of academics or departments interested in national defence; they are accessed by children who operate without fear of computers and skilled in the world of electronic toys and games.

To apply the knowledge and skills of play to education is quite normal for children and software designers have not been slow to exploit this path. To incorporate education programs and content into games is the logical commercial next step and one which will almost guarantee that software designers control both markets. The dangers in this scenario are obvious and should be cause for real concern amongst those associated with education. Issues such as control of information and educational services through fee for service and other forms of restricted access have been a source of keen debate and should be resolved. Schools are conscious of the costs associated with Internet and email and access to CD technology, and the major carriers of digital, cable and satellite services expect to profit from these businesses. So where does this user-pay system leave children? Part of the answer lies in directing education away from commercial products and towards involving children in areas of creative original work and primary research.

The concept of engaging very young primary school students in original field work is being considered by the Royal Botanic Gardens and Department of Natural Resources and the Environment, who plan to verify existing databases and create new data related products such as the first atlas of fungi in Australia. An on-going student project can replicate existing research, trial the suitability of digital camera use and the development of software for collecting managing and analysing species data and displaying this location data on an active screen. Not only does this type of activity provide low cost verification of important research but it engages children in the application of technologies and methodologies hitherto unknown and exposes them to pure research. But there are costs with such projects and they will not proceed without funding and a significant time commitment from experts.

Interactive CDs currently under development and evaluation provide students with opportunities to 'walk' through a virtual heathland, wetland or desert, investigating species, topography, soil type, rainfall and eco-relationships; being able to change the parameters and explore consequences. This technology is already being applied to libraries, museums, galleries and inaccessible geographic locations. Simulations based on definitive high integrity databases exist within the convenient form of the CD and these have been made accessible to all age groups through clever writing which preserves data integrity. The opportunity to alter parameters and interact with the CD creates a digital 'research' environment which is limited only by the integrity of the data and the skill of the programmer.

There are important rare databases relating to all disciplines which are inaccessible to all but a handful of curators and scientists. Digitising these data represents the first significant step to freeing information access to new audiences and on a scale not previously contemplated.

The design, construction and sailing of a boat in the Whitbread Around the World yacht race may seem a meaningless and idle pursuit to many, but it provides studies of materials technology, psychology and nutrition, the development of navigation aids and the opportunity to study ornithology, oceanography and weather. To be able to access all stages of this venture though the use of digital cameras, the Internet and on-line student projects provides a new dimension to the traditional classroom and a generic classroom model independent of location. How better to introduce young children to global information and positioning systems and location co-ordinates, and older students to the complexities of mathematical modelling than through a navigation competition which tracks a sailing boat for over 40,000km. Is this the new research — using primary data and free from commercial influence, and being done by students?

There are those who question embracing of a digital world as a passing fad, but using a motor industry analogy, it would be safer to argue that we are at the model-T end of a digital information and communication era which is being driven by the creative imagination and perceived needs of all age groups. Students need education relevant to the times in which they live and a future which we second guess, but it must be free from commercial control. Business needs digital information and communication technologies to increase efficiencies and reduce costs. Special interest groups including the disabled and the elderly need Internet connected mobile phones, notebook computers, on-line services and email more than most just for basic equity and quality of life reasons. Children need access to the definitive data bases of the Australian Bureau of Statistics, libraries, museums and other government departments. Who better to be involved in the selection of interesting educational databases than children working with educators? Who better to have access to and involvement in projects related to waste management and research on ocean and bay litter than children; the future minders of the planet? Who better to investigate the river systems, salination, water quality and ozone levels than children? What better way to learn about the Australian Stock Exchange, wealth and job creation and the securities industry than by playing the ASX Sharemarket Game on-line. It will be through education projects that we will learn to value historic buildings, marine heritage, air and space history and each other; and on-line projects will facilitate the process and give ownership to those with the need to know. It will be through classroom simulations and quasi-experimental research of things happening now that children will understand the messages of organisations like Sunsmart and QUIT, and the National Heart and Asthma Foundations; learning how to establish ownership and a global view. The value of education sites on the Web cannot be understated in this area of endeavour. The collection of these sites and interactive projects in one location as occurs in the Directorate of Schools Education website, SOFWeb (http://www.dse.vic.gov.au) provides an efficient way of initiating, guiding and publishing student research.

The Creation of Individual Knowledge Webs

The Information Age also offers another perhaps more powerful learning opportunity. It provides the tools to challenge the compartmentalised view of learning which is so often exhibited in the school classroom by the " research project". For the first time students are realistically able to gather, store and retrieve information that they have constructed over a period of years. Students have access to and are expected to use a diverse range of information sources to support their research tasks — books, video, people, maps, statistics, CDRom, on-line information via the Internet. Using information technology and database programs they can store and retrieve not only the final essay, project or product but notes taken electronically, references to useful resources and dynamic links to internet resources. They can create an individual knowledge web which links information stored in a series of files using keywords and hypertext links. A knowledge web is consequently not defined only by information gathered for a particular task but by student interest and student discovery. This reinforces the relatedness of information rather than compartmentalising it. Updating and expanding an individual knowledge web defines learning as an ongoing experience.

The management of students' knowledge webs requires specific guidance in the establishment, maintenance and management of personal databases of information as well as electronic notetaking, keyword searching and the basic categorising of information. However computer technology offers the chance to manage this efficiently and without the dilemmas of storage and retrieval which characterises current practices. Even more importantly it encourages students to value the process and products of their own learning over time.

Issues for Educators

This dynamic digital environment is not without its problems. In terms of the Internet, the search for valuable and reliable sources of information is of prime concern. The search engines, to date, are limited by the uncontrolled standards of information placed on the Web and the search parameters of the search engines. Therefore keyword searching can still be a very hit and miss affair using expensive resources of personal and charged time. The development of sophisticated archiving and indexing systems and clever search engine software is needed as the size and complexity of the Internet grows, but the nature of the Web almost guarantees that the users, especially students will be constantly challenged by features which, by any measure, are unfriendly.

The print based publishing world has by default through its high cost structure limited the number of people who could have their work published. Therefore the credentials, accuracy and quality of authors gave users at least an initial, if somewhat dubious, filtering process. However, in cyberspace where there is access to low cost publishing, users are faced with a very different landscape. They must acquire highly developed information literacy skills. Esther Grassian, UCLA College library has focused on this issue in her paper " Thinking Critically about World Wide Web Resources"

(URL — http://www.ucla.edu.edu/campus/computing/bruinonline/trainers/critical .html) Grassian identified several key elements requiring evaluation in the on-line, hypertext world of the Web — Content and Evaluation; Source and Date; Structure; Interactivity and Security. Of particular concern is the ability to identify the author or producer information on the Internet . The World Wide Web allows virtually anyone to be a publisher. The expertise, credentials, reputation and philosophy are often not disclosed and so it is difficult to attribute value or worth to the information. For those without effective evaluative skills, the work of an expert can be placed alongside that of an interested amateur with an opinion, and afforded equal weight.

Related to this is the security of the data on the World Wide Web. Information provided by an expert can be corrupted by the interested amateur or another expert unless effective protection is established by the original author. This confuses the whole issue of assigning ownership or measuring value and authenticity.

The same level of vigilance is required when evaluating CD ROM materials. Commercially produced CD ROM resources have improved significantly in design and quality of information over the last five years. However, there is still the predisposition to view any multimedia resource as valuable. The premise being that if research information is digital, coloured, has hypertext links with video or animation and displayed on a VDU screen it must be useful. In the early nineties there were many examples of poorly designed CD ROM based packages which had little educational value and certainly did not provide better learning experiences than those using conventional sources. CD ROM resources require levels of critical examination similar to that of online resources from the Internet.

Conclusion

Despite these words of caution it is clear that many of the factors which limited students learning experiences through research projects, to either local exploration or second hand viewing via secondary resources, are overcome when using electronic resources to locate, gather, organise, present and publish.

Each new resource format requires the development of new skills or extensions of old ones to enhance student learning. To make the Internet work within a learning context requires careful preparation. The focus on the development of information literacy skills that equip students with skills and strategies to search and manage the huge information reservoir of the Internet is crucial. Students must become competent researchers and information managers with a well-developed capacity to critically evaluate information for accuracy, relevance and usefulness. These skills have been taught previously with reasonable success within the context of static information sources, using a resource base that was generally defined and organised. The Internet is not organised, defined or static. The dynamic nature and uncontrolled growth of the Internet means that skills which enable students to exploit its potential must be consciously developed. The research process outlined earlier in this paper provides a thinking and strategic framework for the development of these skills. Information literacy within a digital environment uses many of the information skills already identified in the literature. However new skills must be taught if the potential of a digital world is to be exploited.

So who are the new researchers? We would argue that the digital environment has allowed students and teachers to become part of a global research community. This community is one which is premised on information sharing and individual and collective discovery. It requires new skills and new strategies but also builds on old ones. One of the key outcomes of the educative process delivered within a school context is the development of independent, information literate individuals. The research project has traditionally been the teaching approach used to support this outcome. Information and communication technologies underscore the need for information literacy skills but also provide in part the information resources and tools to achieve this outcome.

References

Collaboratory for Research on Electronic Work (1995)
http://www.crew.umich.edu/AboutCREW.html

Gawith, G. (1987) *Information alive,* New Zealand: Longman Paul.

Grassian Esther (1995) *Thinking Critically about World Wide Web Resources*
http://www.ecla.edu/campus/computing/bruionline/trainers/critical.html

Irving, A. (1982) "Introducing study skills " and "Crossing the boundaries : study skills in the curriculum" in *Starting to teach study skills.* Edited by Ann Irving. London: Arnold.

Kulthau, C.C. (1985) "A process approach to library skills instruction". *School Library Media Quarterly.* 13(1), Winter p.35-40

Marland, M. (ed) (1981) *Information skills in the secondary curriculum: the recommendations of a working group sponsored by the British library and the School Council.* London: Metheun Educational.

Shulman, K "Negroponte talks about Net values" *The Age* 13.2.1996

SOFWeb (1996) Directorate of School Education, Victoria (http://www.dse.vic.gov.au)

Victoria, Ministry of Education(1987) *Teaching Information Skills*. Melbourne: Victoria, Ministry of Education.

Wilson, D. (1989) "Research process developed at Scoresby High". *Access*. vol.3(3). p.37-38.

Events Management Education Through CD ROM Simulation at Victoria University of Technology

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The Department of Management, Victoria University of Technology, has recently received a DEET grant to develop a CD ROM events management educational package for post graduate teaching. The project combines innovations in both technology and subject material, by combining CD ROM simulation and events management education. A multimedia company, ADACEL is undertaking the computer programming and a considerable amount of support exists in industry for the project. The objective of the project is to develop high quality management skills for the growing major events industry.

Imagine that you have been responsible for managing a major event and that the event has been a disaster. Perhaps you booked an international singing sensation who failed to turn up or perhaps your advertising campaign was under funded. In either case you have made a substantial financial loss — from refunds demanded or from poor ticket sales. Furthermore, your reputation is now tarnished.

In real life, there are no second tries after the event has taken place. You as the manager must wear full responsibility for its failure to meet its objectives. Imagine though if you could go back in time and develop a feasible contingency plan for a delayed singer or develop a better advertising campaign. With a CD ROM simulation that is being developed jointly by Victoria University of Technology (VU) and ADACEL, a multimedia company, it will be possible for events management students to 'try again' and to learn from their mistakes. They will do this through engaging in the planning and organising of an exciting simulated major event called, at the moment, SuperFest.

A $160,000 DEET grant in the category 'Developing Links Between and Industry and Higher Education' has been received by the Department of Management, VU, to develop a multimedia-based training package for present and future events managers. The project entails the development of a state-of-the-art events management education and training program to be piloted in 1996 as a precursor to an accredited events management course in 1997. ADACEL is providing the multimedia components. The project will be supported by an events industry consultative group.

The objective of the project is to develop high quality management skills for the growing major events industry. The SuperFest element will be a challenging and enjoyable multimedia simulation which will guide users through the planning and running of a major hypothetical festival comprising a range of cultural, entertainment, promotional and sporting activities. Other modules will engage users in planning, resourcing, staffing and control activities. Users will also be required to deal with randomly generated occurrences, as would a real-life events manager.

From discussions at Victoria University of Technology between the Faculty of Business Departments of Management and Hospitality and Tourism Management and the Centre for Research and Graduate Studies a need was identified for events management education. Research indicated that there has been a rapid growth in the events industry in Victoria and Australia over the past five years with an increase in large scale events — resulting in a substantive economic impact. For example, according to Tourism Victoria , the 1994 Van Gogh Exhibition attracted 180,000 visitors and the 1995 Royal Melbourne Show attracted 700,000 visitors. According to the Australia Council for the Arts, paid attendances at arts festivals totalled 2.2 million in 1993-94 and, according to KPMG (1995), the estimation of Sydney Olympics revenue is A$7.3 billion to GDP, 150,000 jobs and 1.3 million visitors. This growth in events is projected to be maintained, in Australia in particular, to beyond 2001.

The occurrences of events, particularly well-attended major events, have been increasing rapidly — events such as conferences and meetings, exhibitions and trade shows, festivals and trade shows , sporting events, tourism attractions, local promotions and special interest events. There is an expectation by events managers that there will be a further growth of major events as we approach of the turn of the century, the Sydney Olympics, the ParaOlympiad, the Cultural Olympiad and the Centenary of Federation celebratory activities. The project will provide an innovative and relevant teaching medium to cater for generic event industry management requirements.

It was fortuitous for the VU events management group that ADACEL had developed a successful project management simulation program which was being used by some large organisations. That particular program, which guides the user through a hypothetical scenario, has now been officially endorsed by Microsoft as an educational game. The two parties (VU and ADACEL) saw the simulation program as an excellent shell on which to base an events management educational package. Considerable modifications will be required to convert the shell to an events management package to accommodate the new scenario and elements including human relationships, teamwork, sponsorship, marketing, tourism, rapid decision making and multi-tasking. Discussions with major event and festival managers indicated that there was considerable industry support for the program. Technological advances, too, have enabled this multimedia training program to be developed in such a manner that it can be effectively and economically delivered as a training and education product for use in VU courses or as part of an international events management education program in the future.

A priority of the program is to develop high quality management skills in the growing major events industry. The high quality management skills of the program will be in keeping with the 1995 Karpin *Task Force Report on Leadership and Management Skills in Australia* for Australia to become "an enterprising nation".

A specific objective of the project will be to educate existing and future events managers about events management concepts decision making processes and appropriate management activities in a variety of events-related circumstances.

Teaching materials will comprise a teaching text and a CD ROM simulation program. The simulation program will guide the user through the processes involved in managing events through a event project management exercise in the form of an enjoyable program which is like a game. The program contains activities whereby the user:

- is given a broad introduction to the program;
- has to identify the optimum plan for hypothetical activities leading up to the event;
- must identify suitable staff members through their CVs;
- is tested regarding knowledge of the key elements of the project such as the overall objectives, the budget, the target market, imperative deadlines to be met and contingency planning; and
- is placed in an exciting simulated event management environment.

As a result of using the program, students will be expected to learn about events management principles, project management, budgeting and making decisions under pressure. The multi-media component will be engaging and challenging, with the intention of stimulating user interest and enhancing learning. Lecturers and students involved in the program will also be able to familiarise themselves with the multimedia teaching/learning mode. Measurement of the learning outcomes will occur though pilot testing and oral and written feedback by students, lecturers and events and festival managers. Modifications will be made, in conjunction with advisers, where improvements are required. The product will be geared to the needs of the events industry and will be continually tested through involving the industry group in its development and trialing.

The SuperFest team, which has now enlisted a real events manager to provide the knowledge base for the highly complex computer-program shell, is highly motivated about the project. The project presents a fascinating learning experience for all.

The Instructional Design Transition from Distance to Flexible Delivery Materials

Grahame Ramsay
OTEN

The techniques of instructional design that have been applied to the preparation of distance materials for independent learning are now being applied to the production of materials that are to be used in flexible delivery of subjects. This allows subjects to be offered which require face to face work but can also have a major component of independent study. This paper will be a case study of the development of a book called Working with Grief and Loss *by OTEN (The Open Training Education Network). Instructional design issues to be considered include the development of project specifications, identifying stakeholders and learners.*

Flexible delivery is a major growth area in the VET sector with TAFE and private providers being encouraged to 'flexibly deliver' their courses. The term appears in key documents and as part of reviews of the existing functions of present organisations. Yet, the use of the term flexible to apply to many kinds of activities (some of which are decidedly inflexible) is somewhat enigmatic. Flexible delivery has been used synonymously with independent learning, open learning, mixed mode, distance education, face to face teaching with some independent learning and even just altering the timetable and duration of classes. Those definitions that do exist do not accord completely with the practice. For instance the National Flexible Delivery Working Party has defined flexible delivery as:

> an approach to vocational education and training which allows for the adoption of a range of learning strategies in a variety of learning environments to cater for differences in learning styles, learning interests and needs and variations in learning opportunities (1992:5)

This suggests a range of options for the same group of students when flexible delivery in practice is much more about delivering to students who for some reason cannot presently access a subject. This is why it has been seen to be the preserve of distance educators who have traditionally provided the flexibility of distance learning. A key feature is that distance education is suitable for students who could not, or did not want to, attend a TAFE college

Despite all the rhetoric about learner centredness, flexible learning is essentially a delivery issue. 'What is critical here is the degree of control various stakeholders are able to exert on the content and delivery of learning programs and of those, which stakeholders might be described as internal to the educational process (ie teachers and students) and which external (government) '(King 1995:3)

This notion of stakeholders is crucial to the following discussion of a specific project. It was stakeholders other than the learners that had the most say on how the materials were to ultimately produced and delivered.

Overview of the project

This case study relates to materials that were to be produced to support the 'flexible delivery' of a TAFE subject called 'Grief and Loss and Working with the dying'

The learning resource that was produced was a result of compromise between the interests of the various stakeholders. It was a book which can be used for independent study by students. It also provides a teachers guide to conducting a workshop that students would attend for some of the course. Its flexibility is that it allows students who would otherwise have had to attend TAFE to undertake a mixture of independent study and teacher led work. The book is being sold through bookshops and has a secondary audience of people interested in the topic who might want to work through independent materials for their own benefit.

Needs analysis

STAKEHOLDER ONE: David Wallace, Personal and Community Services ITD

David Wallace, the Industry specialist, Welfare, in the Personal and Community Services training division of TAFE identified that there was a need for flexible learning opportunities for students undertaking subjects in the Working with Older People Certificate.
He identified the needs as

1. Students in outlying areas, working in Aged Care, whose local colleges did not offer the relevant subjects for whom a mixture of independent study and workshops at a local college would allow them to do the Certificate.
2. Teachers in outlying colleges who would like to offer the subjects but didn't have sufficient students to be allowed to form a class. They could run some workshops and let the students do independent study for the remainder of the course.
3. Students working in Aged Care whose workload prevented them attending the subjects on a regular basis but for whom the flexible delivery could be suitable.

STAKEHOLDER TWO: Learners undertaking the subject

STAKEHOLDER THREE: TAFE teachers in colleges

STAKEHOLDER FOUR: The Education and Training Foundation

An application for funding to the (now defunct) NSW Education and Training Foundation (ETF) was successful. David Wallace selected the Open Training and Education Network (OTEN) to be the organisation that would use the funding to produce materials to meet the needs of the learners.

David Wallace selected OTEN because of its role as both a producer of distance and flexible learning materials and its involvement in the delivery of TAFE subjects. It is useful here to explain that role in a bit more detail.

The role of OTEN

OTEN is the major provider of distance education for the TAFE sector in NSW. It includes a core of teachers, and a group of expert production professionals who produce learning resources. The NSW Minister for Education described the features of OTEN earlier this year as

- Direct course provision for 27, 000 TAFE students and nearly 4, 000 school students
- Support for flexible delivery programs within NSW TAFE Institutes.
- Development and maintenance of a range of print based learning resources covering more than 600 TAFE subjects
- Provision of more than 300 hours of live satellite broadcasts for schools, TAFE and Industry.
- Development and publishing of Interactive services for the Education Network of Australia(EdNA)
- Management of state-wide technology based services for TAFE including its State wide library system and satellite network.

STAKEHOLDER FIVE: The ETRC (OTEN)

David Wallace approached the section of OTEN that produces the learning materials to support distance education students. It is called the Education and Training Resource Centre (ETRC). The project manager was appointed from this section of OTEN.

He clarified needs and then approached the section of OTEN that actually 'delivers' courses to students. It is called the Open Learning Program. (OLP)

STAKEHOLDER SIX: The OLP (OTEN)

One possibility was that OTEN would simply offer the subject 'Concept of loss and working with the dying' as one of its distance education subjects. The learning materials would be produced by OTEN and automatically distributed to students who were enrolled in the subject. The students would be 'OTEN students 'a with all the support and resources that provides.

The OLP rejected this proposal for two reasons:

- There was not sufficient teacher expertise at OTEN to support this particular subject.
- There were no plans for expansion into that area in the near future by recruiting specialist staff.

The result of this was that the materials would still be produced by the ETRC. The question then arose as to how they would be distributed. The Marketing section of OTEN is responsible for the distribution of materials that fall outside the gambit of the OLP. So they were approached.

STAKEHOLDER SEVEN: The marketing unit (OTEN)

There are two levels of distribution by the marketing unit. The first are open learning materials that were developed for distance education courses conducted by the OLP but which have an interest to other people. These are sold at print cost only to anyone who pays their money and orders via a catalogue.

The second kind are books and other materials which have some commercial potential and which are distributed through bookshops and aim to make a profit. The Senior Publications Officer of Marketing decided that the 'Concept of loss and working with the dying ' materials were of the second type and could be a profitable venture.

The question of how students would do this subject was yet to be resolved. After some negotiation it was decided that students would be enrolled in their local TAFE and then the students or the TAFE would purchase the books. Teachers would be employed to conduct a workshop component and to supervise assessment.

STAKEHOLDER EIGHT: Local TAFE colleges

It is obvious from this description that the final outcome of this project would be a compromise between the needs and requirements of at least eight stakeholders often with conflicting agendas. The input of these various stakeholders is dynamic and by no means sequential so that the project changed direction in key ways throughout its life rather than proceeding unchanged from the brief to the final product.

The notion of flexible delivery was itself being renegotiated according to the various compromises that were arrived at during the project.

All this detail is necessary to place in context the instructional design issues that apply to this project specifically and to the general question of distance education versus flexible learning approaches.

Instructional design

The term instructional design is itself replete with meanings and associations. Some of the issues posed at a forum on instructional design at Southern Cross University, in 1994 included the questions: Are instructional designers integral to the large picture of program development or do their activities represent one discrete step in an industrialised production line? Are they project managers or course team participants? Do they practice flexibility and creativity or are they wedded to systems that guide practice within set parameters?(Morgan, di Corpo and O'Reilly, 1994: 172) Perhaps the most obvious common ground found at the forum was the instructional devices and strategies that instructional designers incorporate into materials. These include objectives, icons, access devices, concept maps, headings, margin notes, graphs and tables, advance organisers, activities, feedback, summaries. (Morgan et al 1994:173)

There is evidence that the instructional designer's work varies considerably between different organisations (Weekes, 1994:189) This is also evidenced by the different gradings and classifications that are used in the appointment of instructional designers.

Instructional Design at OTEN

The majority of the instructional designers that are employed by OTEN work on the production of print based materials by ETRC. They are graded as either Education Officer or Senior Education Officer. Most of them also fulfil the role of project manager but they do not fulfil both roles on every project and there are some education officers who specialise in project management. Their role does vary considerably from project to project. (Ramsay, 1995) There are some common guidelines and even instructional design checklists (job aids) that help to define the parameters of their work. (ETRC Guidelines, 1994) These guidelines divide a project into three phases, Planning, Development and Production. ETRC places an emphasis on effective planning and even pays writers a separate fee for this phase. A comprehensive instructional plan has to be worked out and presented.

ETRC also emphasises a team approach with a typical team including Project manager, instructional designer, writer, OLP teacher, reviewer, editor, graphic designer, desktop publisher, and word processor operator. This team is a mixture of outside people on project specific contracts and in-house people working on a number of projects.

The role of instructional designer includes roles such as training and briefing writers, transforming raw material from writers (who are content experts) into learner friendly text, ghost writing, providing a range and variety of learning activities, and project management.

Most instructional designers work on screen and the text once finalised is then edited on screen and Desktop Published. The combination of the role of project manager and instructional designer accords a degree of control and responsibility that is greater than any other member of the team. The development of most distance education material is further aided by the application of a template called Style 3 which uses standardised icons, headings, graphs and tables, activities headings, to speed up the development work.

For the project 'Grief and Loss and working with the Dying' the roles of project manager/ instructional designer were combined. Some of the specific consequences of the project becoming *flexible delivery* mode rather than a traditional OTEN distance education package were:

- revision of the instructional plan to meet the changing parameters of the project because of the impact of the eight stakeholders
- direct negotiation with local TAFE colleges about issues of delivery. Who was going to pay for the materials (students or the colleges). Who was going to set the assessments? How were the workshops organised? How were staff involved to receive compensation for having independent students to look after in terms of advice and help.
- negotiation with the OTEN marketing unit concerning the production of an affordable book.
- deletion of most of the references to TAFE and the actual name of the course and the change of the books title to 'Working with grief and loss'.
- Multiple transformation of the text to accommodate changing design requirements of the OTEN marketing unit.
- Negotiating more expensive copyright clearances because the book was to be sold commercially.
- Involvement of the client (David Wallace) in progressive negotiations about the shape of the project, that is planning after the planning phase would normally have been over.

Conclusion

The opportunity to directly compare instructional design for distance education with instructional design for flexible delivery has been clouded by the complexity of the relations with all the stakeholders. Indeed, this I suspect is one of the key features of flexible delivery that it will inevitably involve reaching agreements between more people. In an ideal world it would be wonderful for the learners if they could have the flexibility to chose between the commercial book, a distance education course run by OTEN and face to face delivery. This is certainly possible in some courses where existing materials are being customised to meet diverse needs. OTEN in fact has a special unit within OLP which is providing advice to TAFE colleges on how this can be done for existing OTEN subjects.

The experience in this project is shared by others working in the area of flexible delivery. As Allen(1994: 162) writes

> The road to flexible delivery does not go in a straight line. There are many bends, hills and pot holes in this road. There is also an increasing amount of traffic, some of which is travelling slowly and not all of it is going in the same direction.

I am confident because of the strength of the writers work and the inherent interest and value of this topic that the commercially available book will be used both by TAFE students and the general public to understand and work through grief and loss. It provides, though, only one form of flexible delivery.

References

OTEN(1995) *OTEN TAFE Course Profile 1995-1999*

Ramsay(1995) 'Instructional design issues in distance language learning packages' in Reid, J (ed) (1995) *Flexible learning* DEANZ: Auckland

Flexible Delivery Working Party (1992) *Flexible Delivery: A national framework for implementation in TAFE*. Queensland Distance Education College

King, B (1995) 'Life, Learning and Flexible Delivery' in Reid, J (ed) *Flexible Learning* DEANZ: Auckland.

Morgan, C di Corpos, O'Reilly, M (1994) "Instructional design — How we know our learners?" in Ellis, A & Lowe, J (1994) *Access through open learning*. Southern Cross University: Lismore.

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Designing CBE for continuing professional education

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Deakin Australia (DA) started designing and producing CBE programs in 1994. Five programs had been completed by the end of 1995. A further four programs will be released during 1996.

Programs are designed for use in conjunction with print and audio materials which are distributed as distance learning packages to business studies graduates enrolled in the professional licentiate program run by the Australian Society of Certified Practising Accountants (ASCPA).

An approach to design and production of programs has evolved over the last two years which takes account of the experience to date. DA's approach to CBE is considered below in relation to a range of CBE design issues.

Overview of Deakin Australia CBE programs

DA programs completed to date or currently in development are briefly outlined below.

Statement of Cash Flows: This program combines instructional sequences with active spreadsheets which enable users to prepare journals, ledgers, worksheets, reconciliations and statements of cash flows and accompanying notes.

Taxation Training Program: A simulated interview takes place between a taxation agent (the user) and a client (the computer). An active spreadsheet is used by the taxation agent to interrogate the client data base in order to complete a taxation return.

Foreign Currency Translation: A series of 29 case studies is presented relating to translating transactions denominated in a foreign currency. Active spreadsheets and a randomising function are used to generate case study data.

Principles and Applications of Risk Management: This program tests the mastery of a range of financial instruments. Mastery of formulae and calculation skills is tested by a bank of short test problems. Understanding of the purpose and operation of instruments is tested by analysis of longer case study scenarios.

Computer-Based Testing: A bank of multiple choice test questions is available for review of course content. Questions may be ordered as tests of particular content areas (over a variety of test lengths) or as comprehensive examinations of course content (again, over a variety of timings). Feedback includes commentary on correct and incorrect test choices and a range of diagnostic statistics of test and examination performance.

Professional Ethics: Use of tabs program involves case study analysis of ethical principles and decision making frameworks. Issues are presented for progressive analysis by users in consultation with a comprehensive data base of instructional resources.

Management Accounting: The user is presented with a data base of problems based on material contained in the printed study guide. Individual problems require an appropriate course of action to be selected from four options. The program analyses the response and provides feedback, including a random challenge feature which requires the user to review and reselect the required course of action. Problems are presented at four levels of responsibility in a mythical company.

Cash Flow Statements: Revised version of the earlier cash flow program. The program presents randomly-generated cash flow statements with appropriate case study data in question and worksheet format. The user is required to reconstruct the journal entries used to produce the cash flow statement. Hints are available indicating problems and corrections to be made.

Foreign Currency Translation (2): Companion to the first foreign currency program to address case study problems in the translation of financial statements denominated in a foreign currency.

This paper also draws on the results of the evaluation of a further CBE program, *Consolidated Financial Statements,* produced by the University of Queensland in conjunction with the ASCPA.

CBE design and production issues

1 CBE and the learning context

Programs produced by DA form part of the learning materials for the continuing professional education of graduates working, or planning to work, as accountants. An overwhelming fact of life for these CPA Program candidates is a chronic shortage of time for study. Candidates typically are in their 20s, work full time, and have a range of commitments besides their part-time study of the CPA Program by distance education.

While the problem of scarce study time did not come as a surprise and was certainly considered in the design of CBE materials, there was some misinterpretation of the impact the problem would have on candidate responses to the initial CBE programs. DA's planning hypothesis was that CBE material would be carefully targeted to content which could effectively harness and capitalise on the power of the computer and would avoid the more discursive content which was best presented as print or audio discussion. This would produce learning economies and would reduce the overall study time required for the semester study program.

This hypothesis hit the spot beautifully for some candidates.

> It was excellent–keep developing it. Make all segments available through interactive learning–it's so much easier. I learnt cash flows 'inside out' in PK 5 hours it would have taken me 5 days on paper. THANK YOU. (Cash Flow)

Unfortunately, for many candidates, the shortage of study time ruled out the allocation of the time necessary to reach a threshhold level of familiarity with the program to obtain any learning benefit.

> Given time constraints of work etc. I was unable to really feel I got through enough to make the best use of the tool. I think it is a very good tool but tries to achieve too much. A simpler version would enable more people to complete the whole and see how it really fits together. (Computer-Based Testing)

> I thought my time better spent learning the content of the course rather than dilute my efforts by using the program although perhaps with more use it would have been of benefit. (Computer-Based Testing)

The design thinking had not anticipated the preference for known study solutions where a restricted study routine led into a print-based, end-of-semester examination. Insufficient attention was also paid to the strong focus of many candidates on obtaining the credential. In hindsight, it is clear that a rather heroic assumption was tacitly adopted in producing the initial programs that candidates would be enthralled by the brilliance of each program and motivated to increase the hours devoted to using CPA Program CBE material. As a consequence they would reap the reward of educational riches in their exploration of this stimulating academic Shangri La. In fact, some did. But many were unable or unwilling to find additional study hours and, instead, made hard-nosed decisions about requirements to gain the professional credential.

Our conclusion was that producing CBE as part of a package of study materials is a vastly different kettle of fish to producing a CBE program which is to be used as a stand alone course of study or an independent reference resource.

The question of limiting the scope of a CBE program leads neatly into the issue of working with CBE authors.

2 The 'Just a bit more' syndrome

Designing CBE is a beguiling and seductive pastime. The authors of the initial Deakin Australia CBE programs were extremely competent professionals and experienced teachers who were also enthusiastic about experimenting with this new (to them) teaching medium. Initial program plans were quite ambitious. As scripting proceeded and authors learned more about the capabilities of the authoring tool used by the programmers, there was strong but subtle pressure to push the scope of the program further, and further, then a bit more.

Each innovation was quite clever and made the power and versatility of the program more impressive. These enhancements were enthusiastically adopted. However, they were not considered from the point of view of the candidate struggling to find the time to prepare for the segment examination.

The 'just a bit more' syndrome is an insidious problem when designing CBE within the confines of a crowded study program.

3 Learning styles and motivation

Evaluations of programs produced to date have confirmed the fact that any population of students will express preferences across a range of learning modes. Some CPA Program candidates are hooked on paper and will remain so: others were Pollyannas for CBE.

> I felt the printed materials were adequate in giving me the necessary understanding. (Computer-Based Testing)
>
> Difficult to read all theory on computer screen as your eyes get sore and one cannot sit in front of computer reading for long periods of time. You could only read it on screen whereas on paper you could highlight, underline it. (Cash Flow)
>
> Overall, the program is excellent. It is the best computer based training program I have used to date.... Using the program does make the learning more interesting. I was surprised that I could sit for several hours at a time in front of the PC using the program without realising just how long I had been doing it for. (Cash Flow)
>
> A good supplement for practical training but not sufficient to take place of printed materials study. (Tax)
>
> I found that computer program was of no use to me because: did not suit my study methods–side notes in text, highlighting and summaries; screen display was limited but unavoidable. With printed matter it is possible to refer simultaneously to several different pages; having to wait while program moved backwards interrupted thought train ... I would not be prepared to study a subject in which some or all of a module was totally computer based. Thank you for the opportunity to test the program, however having previously completed all my study using printed material, it was unfortunately of little use to me. (Cash Flow)
>
> The interactive nature ie the extensive help functions, ability to only involve 'explanations' when required and the paragraph tabs meant you could easily get more info in just the areas you need. (Cash Flow)
>
> Since the CPA courses are predominantly self taught and self motivational, the work tends to be tedious. I personally think the program was more interesting and fun and I preferred to study off the computer as opposed to reading 30 pages of text and trying to answer tutorial questions. (Cash Flow)

While we need to accept the proposition that learning styles do vary, there remains an important role for the instructional designer. Between the extremes of the Luddites and the Pollyannas lies a large number of people whose attitude to CBE is either Uncommitted' or weakly pro or con. The task for the instructional designer is to maximise the motivation of these in-between educational consumers by providing attractive study options within particular learning contexts.

> One important variable in the learning context is whether or not the study program includes a formal examination. If it does, the form of the examination is significant. CPA Program candidates frequently comment in evaluations that because they face an end-of-semester, paperbased examination, they prefer paper-based preparation for the examination - particularly where study time is at a premium.
>
> I found the program to be very good. If the exams were not to be open book I would have worked mainly through the computer assisted package. (Tax)
>
> The exam is not done on computer. I preferred the printed info as I don't like using the computer for everything. Find it easier to learn from printed info and could do so in the ease of my home... (ComputerBased Testing)
>
> I think that the CBT make learning more interesting. However, I only made limited use of CBT because it is less time economy than reading the hard copy materials. (Computer-Based Testing)
>
> Time was a major constraint. Since printed material was provided, I used it instead of the CBT. (ComputerBased Testing)
>
> I liked using the programme but feel that, unless part of the assessment is computer based, its application is fairly limited. (Consolidations)

4 Maximisation of the value of CBE

A question discussed in the professional literature is, how is CBE most effectively deployed? That is, what do computers do best in relation to other instructional media and, therefore, where should CBE resources be concentrated? Viewpoints range across a wide continuum (for example: Amthor, G.R. (1991) or Zalakos, V. (1991) 2 Ellis, D (1994)).

The multimedia lobby argues that the processing power of the computer is best used by the preparation of simulation and problem-solving applications employing powerful manipulative devices such as embedded spreadsheets and sophisticated data bases with hyperlinks to multimedia resources. This viewpoint shuns narrative text CBE material as electronic page turning which is tedious and better presented on paper.

On the other hand, Dan Ellis of Queensland University of Technology (1994) questions the credentials of multimedia CBE pointing to the expense and long lead times for production of multimedia which is not able to demonstrate an improvement in learning effectiveness of multimedia blockbusters in relation to humble (and possibly tedious) text-based CBE.

> The DA experience is not definitive. We have produced programs which reflect values at both ends of the continuum (although our simulation-style programs have consisted of text and graphics and have *not* included audio or video files). Feedback from evaluations has included strong (though not universal) reaction against 'electronic page turning' and broad (though not universal) endorsement of simulation activities.
>
> It is much easier and more enjoyable to complete a tax return via this program than reading four pages of data in a CPA module. (Tax)
>
> Reading from a computer screen sucks. I don't think it is the right medium for reading anyway. Examples yes, Reading no. (Consolidations)

> Leave theory and long text to the programme folders, use computer more for practical illustrations and case studies which may be interactive and allow student to solve problems, do entries etc. (Cash Flow)
>
> The topics were covered quite well with practical examples being more suitable to computer use. I found it difficult to follow the theory topics, especially considering I like to highlight and underline text. (Cash Flow)

These responses are not particularly surprising. What was more surprising (in the first set of evaluations) was the reaction against blockbuster programs irrespective of the nature of the programs. Accordingly, while candidates overall preferred to use the computer for practical applications of CBE rather than presentation of theoretical instruction, this seemed to be subsidiary to the issue that to be valuable at all, CBE had to be presented in digestible chunks and capable of productive study use after a very brief program orientation. In other words, the best programs were those that could benefit the user irrespective of whether he or she devoted 2 or 22 hours to the program over 2 or 22 separate study sessions.

Having made this point, it must also be said that some users were impressed by the blockbuster programs and indicated that they anticipated using the programs extensively as reference resources quite independent of their CPA Program studies. We are, therefore, retaining the blockbusters as independent skills programs within the ASCPA's overall professional development activities, but reshaping those CBE programs which are to be offered within the CPA Program.

5 Approaches to authoring

DA has tried several approaches to the way that authors script program content.

The initial system emphasised a large team approach and detailed preparation of a development blueprint. A series of meetings was held to map out the fine detail of program structures and functions. The outcome of this process was to be a detailed coded flow chart which would allow programming to proceed smoothly to faithfully reproduce the blueprint. This system was quickly abandoned when authors became bogged down in the mysteries of the flow chart and the coding system. Development then proceeded according to an evolutionary model whereby authors would submit scripts as prose content for display with prose directions regarding program functionality. Programmers would then interpret the script and return programmed sections for review and refinement by the authors. The cycle was repeated a number of times until programmers and authors were happy with the result. This approach seemed to work well, although, in hindsight, this probably reflected the fact that the programmers had had considerable prior experience in CBE business finance applications. Another by-product of this approach was a considerable dose of 'just a bit more' syndrome, as explained earlier.

When new programmers replaced the departed first generation of DA programmers, the evolutionary approach to scripting became unwieldy and inefficient. Scripting became unduly protracted, relying increasingly on complicated email, fax and phone communication. Programming became more stop/start and frustration levels of all team members rose.

The current scripting model has reverted more to the initial blueprint approach. However, initial planning meetings and related discussion and documentation is carried out in everyday language rather than complicated code and is interpreted and referred back to the planning team by programmers for confirmation as a progressively-developed design specification. No programming is undertaken until the design specification has been finalised on paper. Scripting takes place in prose after agreement on the design specification and according to scripting layouts agreed with the programmers. Blood pressure seems to be much more under control since this system has been adopted.

Current developments

CBE projects currently in development reflect the accumulated experience of programs developed over the last two years. While the current programs vary in structure, content and style, certain elements are consistent:

1 Programs are essentially applications of theory and/or practical skills practice rather than presentation of learning content. Learning content is contained in the printed study guides supported by audio cassette tutorial discussion.
2 Programs are modular and allow users to tailor study sessions to their own requirements. Content is organised into case studies and randomising programming techniques provide a supply of unique problem situations for user analysis.
3 Programs provide several levels of help for user consultation plus detailed feedback on program tasks.

One of the current developments is a program which provides an analytical treatment of professional ethics.

Professional Ethics

The ethics program relies heavily on screens of textual information. However, an effort has been made to confine this text to a minimum necessary to analyse case study essentials as a lead-in to a more detailed interrogation of the ethics data base on which the main program is built. In this program, the computer is being used to overcome key problems in the traditional print presentation of the ethics material. Candidates have been overwhelmed by the teaching content in printed form because it is conceptually difficult and qualitatively different to the academic disciplines most candidates have encountered in under-graduate study programs. At the same time, authoring the print material has been difficult because a balance has been needed between providing a challenging array of resource material and keeping the whole sequence manageable for the 'average' candidate.

The computer program on ethics has adopted a case study approach in conjunction with a comprehensive data base of support material. Candidates may select a case and use the case framework as a means of exploring the data base. Candidates may explore in as much or as little depth as they choose in whatever study sequence they choose. The computer program, we believe, will serve to encourage users to make better use of the printed content on ethics presented in the study guide.

The Deakin Australia experience of CBE

While clear directions have been suggested by the CBE development work done at Deakin Australia, it is difficult to derive definitive rules for the design of CBE. The computer is an extremely flexible teaching device and is able to be applied in a range of settings to enhance learning opportunities. In the Deakin Australia CBE instructional environment, two guiding principles have emerged: 'small is beautiful' and, more generally, 'will this help candidates to prepare efficiently for the examination.'

References

Amthor, G.R. (1991) "Interactive Multimedia in Education", *T.H.E. Journal* 1991.

Zalakos, V. (1991) "Why Multimedia?" *NSW Computer Education Group 1991 Conference Proceedings*.

Ellis, D (1994) "Barefoot Multimedia, Or, All is Not What it Seems", Moriarty Paper presented to the International Federation of Information Processing TC3/ Working Group 3.2 Working Conference, *Interactive multimedia in university education: designing for change in teaching and teaming*, held at the University of Melbourne from 6 to 8 August 1994.

Electronic classrooms and lecture theatres: Design and use factors in the age of the mass lecture

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The most recent definition of instructional technology produced by the Association for Educational Communications and Technology says:

> Instructional technology is the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning [1].

While this is a very broad definition it certainly encompasses the issues which we are dealing with in this paper. As Michael Albright has recently said when discussing the important differences between information technology and instructional technology: "Remember that setting is an important concern of instructional technology, including such environmental conditions as climate control, quality of seating, upkeep of the chalkboards and marker boards, and the other things that typically drive faculties crazy. As instructional technologists, our turf begins at the classroom wall."[2] So while the last ten years has seen a great development of computer technologies being used for student instruction at universities and a variety of communication technologies being used for open learning enrolments, it is still likely that for the majority of students at Australian universities, the majority of their contact with academic staff takes place in a lecture theatre or classroom. The students contact with any form of educational technology is more likely to be with technology in a lecture theatre than it is in a computer laboratory. While this generalisation is rapidly changing, we feel it is important that those in the educational technology field do not lose sight of the importance of providing a technologically rich environment in which academic staff and students will continue to have lectures, tutorials and seminars on campus.

Designs for the '90's

The 1990's has seen a rapid development of various communication technologies, a great rise in undergraduate student numbers with a consequent rapid rise in the size of many undergraduate classes and a less than proportionate rise in general staff numbers as the universities struggle to make the efficiencies pressed on them by Canberra. The characteristics of the undergraduate student have also changed, reflecting the wider changes in the society, suggesting academic staff adopt teaching styles more in keeping with the experience, expectations and knowledge of today's undergraduates.

With the rise in student numbers at Australian universities over the last ten years, there has also been an ongoing process of universities constructing new teaching spaces, often including quite large lecture theatres, while older buildings on some campuses are being refurbished.

The extent to which institutions will provide appropriate budgets to allow this development to occur adequately will also depend on many factors, such as the importance placed on teaching in the institution and the skill and determination of the staff charged with providing these facilities. The installation of electronic classrooms and lecture theatres is a trend that is strongly under way in some overseas countries, particularly the USA. [3,4,5]. So far there has been little research into the effectiveness of these electronic classrooms either from the point of view of changing large group teaching strategies or the effect on student learning which should be the final goal of all such applications of technology to the teaching process.

This paper is therefore divided into two main parts. We will outline for you how QUT has gone about providing electronic classrooms and secondly, we will present some data on how staff and students are using the technology that is now being installed in the media equipped lecture theatres (MELT's) at QUT.

The QUT approach

QUT places a high priority on teaching as one of its aims is to be the best teaching university for undergraduates' education in Australia.[6] Some external evidence for this was demonstrated when, in 1993, QUT was awarded the inaugural University of the Year Award by the *Good University Guide* for the quality of innovative teaching, support for undergraduates and the balance between intellectual challenge and practical skills in its courses. Further evidence of QUT's interest in promoting good quality undergraduate teaching can be seen in the internally funded small, large and infrastructure teaching grants which have been in place for a number of years and which, in 1995 totalled $870,000. Many of these grants have been for the development of teaching innovations related to the use of instructional technology.

In support of this mission of sustaining high quality undergraduate teaching since 1992, QUT has been funding a program of installing 'smart' lecture theatres, or as we now call them MELT's, (Media equipped lecture theatres), in new buildings and in refurbished theatres. A significant component of the funds for the refurbishment of existing teaching space has come from allocations to the Department of Audiovisual Services out of the Quality funds that have come to QUT. In 1993, the Audiovisual Services' share of these funds for the MELT project was $312,000 and in 1994, $230,000. The Computing Services Department has also been funding the connection of existing lecture theatres to the computing network, while in one year, a small sum came from the QUT Long Term Information Technology Plan funds, to buy some AMX theatre control equipment for a couple of theatres.

The first theatres to be equipped with any type of theatre control system were six lecture theatres constructed in a new 12-storey Information Technology and Engineering (ITE) building on the Gardens Point campus. This building was under construction when I took up my position at QUT in 1991.

Although I was asked to provide advice on the audiovisual fitout of the lecture theatres and classrooms, of which there were about twelve, there was little we could do to fix the basic design of the lecture theatres. However, the external contractor did quote to fit AMX button lecterns and we did manage to get enough money for four video projectors. This initial building set the model.

This section of the presentation will describe our goals and attempts to achieve them.

The Ideal Theatre

If we could offer every facility users have requested and resolve every criticism made, our ideal theatre would have the following characteristics:

1. Perfect projected images which everyone in the theatre can see perfectly regardless of lighting conditions.
2. Perfect acoustics so everyone can hear perfectly.
3. Access to every possible media source.
4. Invisible technology which requires no expertise to use — and never fails!
5. Infinitely variable size and seating arrangements to adapt to differing needs and personal teaching style of the lecturer.
6. Unlimited whiteboard/chalkboard space which can be clearly seen by all students.
7. Unlimited support staff who arrive within ten milliseconds (twenty milliseconds after hours!)
8. Zero cost.

The Reality

Unfortunately, none of the above ideals are achievable and at best we can only offer a compromise. Our challenge as system designers is to achieve the best compromise. Some aspects are well beyond our control, but we can influence some. In particular it is our duty to:

- ensure the correct technology is installed
- modify the physical environment to allow the technology to function properly
- train the users to use the technology effectively
- keep the technology up-to-date

Let us explore some of these points in more detail.

Correct Technology — It is vital that any technology installed in a theatre matches the *real* needs rather than fit within a pre-determined budget. For example, when selecting a data projector for a large lecture theatre, the end result must be a clearly visible image for all students. The theatre size dictates the image size, which dictates the projector's brightness requirements, which in turn determines the cost. Using the 'what can we afford? approach, will almost invariably result in an installation which does not satisfy the basic need.

Physical Environment — (Physical environment refers to lighting, acoustics, ventilation and furnishings.) The physical environment is the single most important factor governing the success or failure of a theatre to fulfil its intended role. It is also the area of responsibility which varies most widely between institutions.

A lecture theatre is a presentation venue. A presentation involves a visual and an audible component, both of which must be conveyed clearly to the audience (students). The actual theatre environment has a significant influence on the quality of the information received by the individual students. Apart from the correct technology, we need:

- Good acoustics — low reverberation levels and maximum isolation from external noise
- Lighting configuration and control optimised to suit presentation and projection needs
- Unobstructed sightlines to all screens and to the presenter
- Sufficient screens and whiteboards/chalkboards to display visuals
- Comfortable environment for students — adequate ventilation and temperature control, good seats and adequate note space

The design process must consider all of the above, but some are outside the traditional scope (and control) of a media or audiovisual section. Regardless of organisational structure or internal politics, it is vital that all these requirements be strongly impressed upon the theatre designers — it is surprising what will be overlooked if *anything* is assumed! For a new theatre, it is possible to satisfy all the goals above. For refurbishment projects, the scope for optimising the environment will vary — but it is important to strive for the best compromise. I would like to discuss some aspects of the physical environment in more detail:

Lighting — There are some 'golden rules' which should be obeyed when designing or specifying lighting systems for a lecture theatre:

- Lighting should be configurable to suit varying needs in the theatre — from bright, omni-directional lighting for examinations to zoned, low level down-lighting for projection.
- Lighting for projection must be 'vertical' — ie. there should be a minimum of horizontal lighting which will wash onto projection screens.
- There must be sufficient light for students to take notes, but a minimum of light washing the screen
- Lighting should be zoned to permit fine control of levels in various parts of the theatre

From our experience with many theatres (and electrical consultants), we have settled on a preferred lighting configuration which may or may not apply elsewhere. At QUT we now specify two lighting systems — fluorescent for general purpose lighting and dimmable incandescent for controlled lighting for presentations.

Theatre shape - The optimum design for a presentation theatre roughly adheres to the following rules:

- The optimum floor plan is *rectangular* and the length approximates 1.5 to 2 times the width.
- The ceiling height at the display wall will be at least one-sixth the length of the theatre plus 1.8 metres. (Example: For a theatre 18m long, the ceiling should be at least 4.8 metres high.)

- The floor will be tiered to permit good sightlines for all students. A typical rake of 15 degrees is desirable.

Case Study: QUT's Media equipped lecture theatres

We cannot provide users with the ideal theatre mentioned above, but our challenge is to provide the best compromise. QUT experimented with a number of designs, some of which failed and some of which worked quite well. A brief description of some of QUT's successes and failures follows.

Successes

Our first objective was to create a consistent user interface which offered the lecturer control of all theatre facilities — not just AV controls — from the lecturing position. We met this need with AMX control equipment which allowed us to create a standard interface on a standard control panel. A lecturer can be time-tabled into a variety of theatres, but the user interface is virtually identical — no need to learn where the switches and controls are for each theatre. I would rate this standardisation of controls (and technology behind it) as one of our major achievements in lecture theatres.

User feedback indicated some dissatisfaction with the Lectrum lecterns — lack of note space and no room for a laptop or notebook computer — so we experimented with custom benches and control consoles. We tried a number of schemes and found the most successful method was to house most of the AV equipment in racking in the bench and to house monitors and the AMX control panel in a console. This places all the AV technology within convenient reach of the lecturer.

One piece of technology which caused (and is still causing) some heartache was the computer. Eventually we decided to 'take the plunge and install permanent PC's in theatres. Despite some frustration with tampering and software corruption, the inclusion has been well justified and appreciated by users as illustrated by usage data gathered by the AMX system. The benefits far outweigh the drawbacks. I would rate the inclusion of PC's in theatres as a success.

Another success was the installation of wireless PC mice in theatres. This allows the lecturer to control computer presentations away from the lectern. It is standard equipment in all PC-equipped theatres and very popular! Finally, I rate our logging of actual technology usage in theatres as a successful innovation. Gathering real usage data (as opposed to relying on surveys) gives a powerful tool for decision making and planning. For example, we can accurately state that the average use of Photo CD players in 1995 was less than 20 minutes per theatre for the entire year, and therefore we can justify no longer installing them.

Failures and dead-ends

In 1992/3 we attempted to design a very compact lectern which incorporated Touchscreen control panel and display for the computer and video sources.

The space and size requirement dictated an active matrix LCD flat screen display. Despite much experimentation, we were unable to source technology which met our needs. The LCD in the lectern was abandoned and we installed a multi-sync monitor on a mobile stand near the lectern. We were defeated by available technology!!

Two later attempts to use one monitor for both PC and video also proved unsatisfactory. One trial converted the VGA signal to PAL video and fed to a video monitor mounted in the lecturer's console. The low-cost scan converter we used created a flickering, poor resolution picture and was limited to 640 x 480 VGA thereby restricting the PC to VGA resolution. The other attempt used a video capture card in the PC to create a video window on the (S-VGA) PC monitor. However, this proved troublesome because the software was a little unstable and required the lecturer to be conversant with Windows to display a video image. Both ideas have now been scrapped in favour of separate monitors for PC and video.

A particularly spectacular failure occurred in a brand new 430-seat theatre in 1993. Our advice that a conventional 3-tube data projector would be unsatisfactory was ignored. The end product was a new and expensive facility which could not perform its primary role as a presentation venue. Loud protests from users soon produced the desired results — the money for the expensive 'light valve' projector we originally specified suddenly appeared!! Happily, our recommendations are now taken seriously.

Assessing the MELT effectiveness

A feature of QUT is the existence of a series of academic groups know as Teaching, Reflection and Collaboration groups (TRAC) under the umbrella of the Academic Staff Development Unit (ASCU.) One of these groups was formed by staff interested in teaching to large classes and the Director of Audiovisual Services joined this group which, in 1994, obtained a grant to do a number of things, one of which was to survey staff and students about their experiences of teaching and learning in large classes at QUT. We have subsequently continued to survey staff on their use of the MELT's whenever a new MELT comes into use and now have data from mid-1994. The following analysis is derived from three separate surveys of staff who had taught in media equipped lecture theatres at QUT. The figures for 1994 were taken from a questionnaire sent to all academic staff from the Teaching and Learning in Large Classes (TALLC) group. In this survey, staff were asked to indicate if they had taught in one of the lecture theatres that had been equipped with AMX theatre control systems and data projectors. The figures below are based on the responses from staff who had taught in one of these MELT's, not from the general reply to the questionnaire. There were 30 responses to the mid '95 survey and 23 to the end of '95 survey. In mid '95 six theatres were surveyed and at the end of '95 another series of five theatres surveyed.

Technology usage

Items 9 to 23 asked staff to indicate the frequency of use of the equipment installed in the nominated theatres and also rate the items perceived usefulness.

Item	Response	End 1995	Mid 1995	1994
Item 9 — Blackboard/whiteboard	Not available	4.3%	3.3%	-
	Never used	21.7%	6.7%	3.8%
	Used occasionally	34.8%	40%	27.8%
	Used frequently	17.4%	13.3%	34.6%
	Always use	21.7%	33.3%	33.6%

Comment: It would seem that staff teaching in the 5 nominated theatres in 1995 are using the board less than staff in 1994. At the end of 1995 there was a significant decline in the use of the boards. The 'never use' response is now the same as the 'always use' response which marks a change from the 2 previous surveys.

Item	Response	End 1995	Mid 1995	1994
Item 10 — Overhead projector	Not available	30.4%	-	-
	Never use	8.7%	3.3%	-
	Used occasionally	4.3%	13.3%	3.7%
	Used frequently	13%	16.7%	38.6%
	Always used	43.5%	66.7%	57.54%

Comment: The OHP is by far the most frequently used piece of AV equipment in lecture theatres but these results would tend to suggest that some staff are using the OHP less frequently than they were in 1994. The high percentage for 'not available' at the end of 1995 is a reflection of the fact that in 3 of the 5 theatres surveyed the OHP had been replaced by a visualiser.

Item	Response	End 1995	Mid 1995	1994
Item 11 — Electronic visualiser	Not available	17.4%	4.8%	-
	Never used	13.0%	57.1%	51.7%
	Used occasionally	21.7%	14.3%	22.4%
	Used frequently	13.0%	4.8%	13.7%
	Always used	34.8%	19%	12%

Comment: This device is fitted permanently to only one of the 'smart' theatres surveyed in 1995 and was installed in only two of the theatres surveyed in 1994. At the end of 1995 3 of the 5 theatres in the survey had a visualiser installed instead of an OHP.

In both 1994 and 1995 a high percentage of staff failed to complete responses to this item thus the accuracy of the results is open to question.

Item	Response	End 1995	Mid 1995	1994
Item 12 — VHS Videotape recorder	Not available	4.3%	-	-
	Never used	47.8%	29.6%	23.9%
	Used occasionally	30.4%	29.6%	42.39%
	Used frequently	17.4%	37%	26%
	Always used	-	3.7%	7.6%

Comment: It would seem that the use of video material has increased slightly since 1994 in mid 1995 although a slightly higher percentage of staff in both 1995 surveys claim to never use video material than in the 1994.

Item	Response	End 1995	Mid 1995	1994
Item 15 — Personal computer	Not available	8.7%	3.4%	-
	Never used	47.8%	48.3%	47.2%
	Used occasionally	4.3%	27.6%	31.9%
	Used frequently	8.7%	3.4%	11.1%
	Always used	30.4%	17.2%	9.7%

Comment: Each of the lecture theatres surveyed in 1995 had a PC installed while in 1994 only one of the 15 theatres surveyed had a PC installed. These results reveal a steady increase in the use of the PC in teaching large groups once the PC is installed permanently in the MELT.

It is strange that some lecturers were unaware that a PC was installed in the lecture theatre they used during 1995. In 1994 the staff claiming that they used a PC in one of the nominated theatres would have meant that in most cases they brought their own PC into the theatre and connected to the data projector. It is perhaps disappointing that the use of PC's has not increased even more despite the fact that the all the theatres surveyed in 1995 have a PC installed in the bench.

Perceived usefulness	Response	End 1995	Mid 1995	1994
Item 15 — Personal computer	Not at all useful	8.7%	7.7%	6.4%
	Slightly useful	4.3%	15.4%	20.7%
	Useful	13%	30.8%	24.6%
	Very useful	52.2%	46.2%	48%

Comment: It would seem that there has been an increase in the perceived usefulness of PC's in lecture theatres although a majority of staff do see the PC as being useful or very useful in teaching in lecture theatres. Note that in the end 1995 survey 21.7% failed to check this box on the perceived usefulness of the PC.

Item	Response	End 1995	Mid 1995	1994
Item 17 — 35 mm slide projectors	Not available	13.0%	-	-
	Never used	82.6%	71.4%	47.5%
	Used occasionally	4.3%	17.9%	39%
	Used frequently	-	7.1%	6%
	Always used	-	3.6%	7.3%

Comment: The use of 35mm slides has declined since 1994. Other data available to the Audiovisual Services Department indicated that in some lecture theatres the slide projector is very frequently used but in other theatres it is rarely used. Perhaps in certain subject areas high quality colour still images are a necessary teaching device, but in many areas they have a limited role. It is a concern that 13% of staff teaching in the new Z block were unaware that each lecture theatre had a slide projector installed.

Perceived usefulness	Response	End 1995		Mid 1995		1994	
		Lectern	Radio	Lectern	Radio	Lectern	Radio
Item 19 — Lectern/radio microphones	Not at all useful	13%	4.3%	11.5%	25%	9.3%	13.1%
	Slightly useful	8.7%	4.3%	15.4%	8.3%	31.3%	23.5%
	Useful	30.4%	17.4%	26.9%	16.7%	31.3%	23.6%
	Very useful	30.4%	56.5%	46.2%	50%	48.8%	56.5%

Comment: While the majority of staff perceive microphones to be useful when lecturing it is of concern that in mid 1995 about 30% of staff saw little use for this technology. By the end of 1995 this percentage had declined significantly.

Item	Response	End 1995	Mid 1995	1994
Item 21 — Handouts	Not available	8.7%	-	-
	Never used	13.0%	3.7%	2.1%
	Used occasionally	39.1%	33.3%	27.6%
	Used frequently	17.4%	18.5%	35.1%
	Always used	21.7%	44.4%	35.1%-

Comment: It is clear that handouts are a frequently used teaching aid. The following percentages on perceived usefulness also confirm that staff see handouts as valuable learning aid for the students although the use of handouts seems be declining.

Item	Response	End 1995	Mid 1995	1994
Item 22 — Touch-screen control systems.	Never used	4.3%	10%	32.2%
	Used occasionally	8.7%	6.7%	16.1%
	Used frequently	4.3%	13.3%	20.9%
	Always used	82.6%	70%	30.6%

Comment: Each of the theatres surveyed in 1995 had the touch-screen user interface for controlling the theatre technology. The theatres surveyed in 1994 had a mixture of touch-screens and button panels. The 1994 survey also specifically mentioned the AMX system which is the product name of the equipment and many staff were unaware of this fact which affected the reliability of the 1994 results.

The 1995 results show that most staff interact with the touch screen on a regular basis. It is a worry that in mid 1995 10% of staff still managed to teach in these lecture theatres without using the touch screen at all. By the end of 1995 however the vast majority of staff did use the touch screen system during their lectures. The touch screen controls virtually all features of the theatre, including the lighting. In smaller theatres however, there is a standard OHP and blackboards so it would be possible to teach in these theatres without interacting with the touch screen.

Question	Response	End 1995	Mid 1995	1994
Item 24 — Has the installation of theatre control systems, video projectors, PA systems, etc. enabled you to adopt any different teaching strategies or present information differently during your lectures?	Yes	60.9%	53.5%	53.6%
	No	39.1%	46.7%	46.3%

Comment: In each of the surveys just over half the staff who responded to the question felt that the smart lecture theatres had resulted in them doing things differently when lecturing in the space. It is of interest however that there has been little change in the responses to this question between the first two questionnaires while by the end of 1995 there had been a greater shift in attitude. It would seem appropriate that steps could be taken to encourage staff to use different strategies and present information in a different light so that a higher percentage of staff were willing to respond 'yes' to this question.

The 'yes' comments revealed several staff who said that they now used PowerPoint or used the computer to show the class software packages. Others felt they were most easily able to integrate various media into their teaching: "Now easily able to integrate video, OHP, 35 mm slides etc. into lecture format"; "All flows more smoothly": "The transition from spoken to audiovisual material is now far smoother and more professional." "Visualiser to perform in class experiments using small objects previously passed around."

There were some similar comments made in the end of 1995 survey. "Electronic visualiser permits demonstrations of small items eg flower, grasshopper"; "I have now put all my overheads on PowerPoint which makes presentations more effective + professional and access to notes for tutors etc easier"; "Easy to incorporate a variety of mediums"; "The PC with network connections allowed me to do 'live' demo's of programming concepts and examples."

Those who answered 'no' to this item generally claimed that they did not have enough time to prepare new material for use on the PC or other media.

Impact on Teaching Strategies

As might be expected when a cross tabulation was done to see if there was any correlation between years of teaching experience and attitude to the use of the educational technology, those staff who had the least experience were slightly more likely to report that the educational technology in the theatres had enabled them to change their teaching strategies. There did not seem to be any correlation between level of appointment and attitude to using technology in teaching.

Staff Training

On reviewing the outcome of these questionnaires, it became clear that if a higher percentage of staff were to adopt different teaching strategies, a more vigorous staff training program was required. It is clear that QUT has provided very little in the way of direct funding to assist academic staff develop teaching skills in using the MELT's. This need to devote resources to the training of staff has been identified in a recent article by Walter Wagner, Paul Heye and Chia-jer Tsai at Florida State University who considered inter-relatedness between the issue of institutional development, faculty development and technology and innovation. They conclude this useful study by stating "....that in order for any technology or innovation to significantly improve the learning results of higher education institutions, there will have to be strong institutional and faculty development program in place to strategically plan for, implement, disseminate and maintain that technology. Until the culture of the institution is readied by such a change, the addition of educational technologies will remain ineffective add-ons to the traditional model of instruction."[7] In recognition of this inadequacy of response by the institution to the introduction of the MELT's as part of the quality allocation to Audiovisual Services Department in 1995, a simulated lecture theatre training venue was established. In 1996 this venue has been heavily used by Audiovisual Services to instruct staff on the use of the technologies available in the MELT's. It will remain to see what influence this venue will have on this issue of changing staff's ability to use the technology effectively when teaching large classes.

Conclusion

This paper has outlined how one of the largest universities in Australia has approached the task of upgrading the physical infrastructure relating to large group teaching. The Audiovisual Services Department has played a significant role in this process with the aim of producing teaching spaces that are flexible and capable of displaying a variety of instructional media in both new and refurbished spaces. Staff use of this technology has been surveyed over an 18-month period and some changes in the way technology is used with large classes has been observed. While the younger staff seem to adapt their teaching strategies to make use of the new technology available in the larger lecture theatres, many of the older staff, with more than 10 years' teaching experience have remained resistant to change, despite now being faced with very large classes. To ensure staff do make effective use of the technology available, much more attention must be given at QUT to staff training in effective use of the technology for large group teaching. It is naive to expect that just because computers and touch screen theatre control systems etc. are installed, that academic staff will automatically adopt new teaching strategies to make use of the available technology.

References

1 Seels, B.B. and Richey, R.C., *Instructional Technology: The Definition and Domains of the Field*, A.E.C.T., Washington, D.C., 1994.

2 Michael Albright 'Media centers and instructional technology in an era of information technology', *College and University Media Review*, Fall 1995, Vol. 2, No. 1, p49.

3 Anderson, James A. 'Supporting Faculty with media equipped classrooms: Considerations for design and implementation,' paper presented at the Annual Conference of the A.E.C.T., Feb. 1990;

4 Barker, Bruce O. and Bruce Harris, 'Establishing and Using an Electronic Classroom: The Western Illinois Experience', paper presented at the regional 'Teaching with Technology' conference, Moline, Il, April 1993.

5 Sr Elaine DesRosiers, 'How Twenty College and Universities Handle Multimedia in the Classroom', paper presented at the Fall Conference of the C.C.U.M.C., South Dakota State University, October 1995

6 QUT, Strategic Plan 1995-2000, QUT, June 1995.

7 W. Wager, Paul Heye and Chia-jer Tsai 'Technology needs assessment in higher education,' *College and University Media Review*, Fall 1995, Vol 2, No 1, p24.

Reconceptualising pedagogy: Students' hypertext stories with pictures and words

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Hypertext software permits students to write non-linear stories which include pictures and words. The characteristics of these stories may be affected by student and teacher understandings of how pictures and words may be combined to produce meanings for the reader. The use of images and words in comic books and childrens' picture-books contribute to a shared cultural experience for students and teachers. The consequence is the initial conceptualisation of theory applicable to hypertext stories, and a modelling effect which influences the nature of what is written. Conclusions in this paper are supported by data from a group of students who wrote hypertext stories with pictures and words.

> "What is the use of a book," thought Alice, "without pictures or conversations?"
> (Carroll, 1988, page 2)

Reconceptualising pedagogies of writing with pictures and words

Media permeates culture. Our culture is saturated with the mental images generated by the advertisers use of electronic media. The extent to which our culture, and presumably, attitudes to story-writing in school are affected have been described by Kearney (1988), who noted that:

> Everywhere we turn today we are surrounded by images. ... Even those areas of experience that some might like to think of as still "unspoilt" are shot through with images. It is virtually impossible today to contemplate a so-called natural setting, without some consumerist media image lurking in the back of one's mind, [eg] ... a wild seascape without a hair spray or tourism commercial. (p1)

However, schools sometimes appear relatively untouched by electronic media. Recent research by Breen, et al. (1994) has reported literary practices from twenty-three families in six communities, and contrasted it to the literary practices observed in nine schools. They concluded that classroom environments, unlike homes, were dominated by print.

When teachers ask students to write stories in English classes in secondary schools, it is likely that the stories will also be dominated by words, rather than pictures. Few English teachers have expertise in combining pictures with words, and there is little readily available information for teachers which explains how it might be taught. For those teachers who wish to teach their students how to combine words with pictures to create a story, research information would be helpful. Observations derived from students' work with pictures and words could provide a practical contribution.

Collectively, English teachers in secondary schools are faced with social and literary contexts which valorise change, diversity and choice. Their students can construct a range of narratives which include linear and non-linear stories. Findings from this research relates to students' hypertext stories, but it is likely that it would also be applicable to traditional linear stories with pictures and words.

This paper argues that a study of students' hypertext stories, using pictures and words, will be assisted by a perspective gained from the study of picture-word combinations in traditional non-electronic media. The selection of particular models for examination from the broader literacy-related contexts to which students and teachers are exposed is to make a pragmatic decision based on the need to consider how picture-text combinations in other media can begin to influence hypertext composition. Comics and picture books are suggested as models for student writing and contributors to a beginning reconceptualisation of a pedagogy of story writing with pictures and words.

The context for the stories

This paper describes one example of student writing, where students, working in pairs, wrote collaborative hypertext stories with pictures and words. The students in the study were a group of nineteen year eight girls in an English class at a private girls' school in Queensland, Australia. Their average age was thirteen years. The class teacher was able to allocate six forty-minute periods in a computer laboratory to this writing work, in addition to two planning periods in a normal classroom. Students were advised that approximately five hundred words should be included in each hypertext story, but that, in addition, as many pictures could be used as were necessary, providing that the students created them themselves. A small group of the same students had been trained previously in volunteer lunchtime sessions, using the nominated software, *Linkway*, and this helped in the reduction of the expected learning curve with software. The school was regarded as prestigious, and the girls were generally articulate and positive towards education and composition-related activities. A characteristic of the students was that technology was an integral part of their lives. 100% of the sample of nineteen students had watched television at home in the last week, 63% had used a VCR, and an equal percentage had used a computer. This group of students used a rich variety of media in their daily lives, including print and electronic media.

Students seemed to have an excellent understanding of what was required when the teacher explained that the writing of a story with pictures and words was central to their task. The software *Linkway* which was used for this activity, allowed for the creation of hypertext stories with both pictures and words. During this process interview protocols were used in addition to questionnaires, tape recordings of conversations at the computer, and field notes of student activities. Data from this study is referred to during discussion.

Students were asked to produce their own pictures, using the drawing tools available in the program *Linkway*, and to use the completed images in combination with the words to produce hypertexts. Although it was possible to incorporate other media in this work, a conscious decision was made to use relatively simple media, in order that the writing would not be excessively dominated by students' day to day concerns with the technology. The influence of these two media, comics and childrens' picture books, can be seen in the way that students combine pictures and words in their hypertexts.

Comics

Comics have been an important part of children's reading for many years, and teachers, too have usually been readers of them at some stage. In the USA, Waugh (1947) argued that in the 1940's, 95% of boys and 91% of girls bought comics regularly, between the ages of six and eleven, a figure which fell only slightly to 87% of boys and 81% of girls for the ages twelve to seventeen. In West Germany, in the 1970's, Reitberger and Fuchs (1972) noted that 144 million comics were being sold annually. In Australia, the extensive displays of comics available in newsagents suggests that comics continue to be an important formative influence

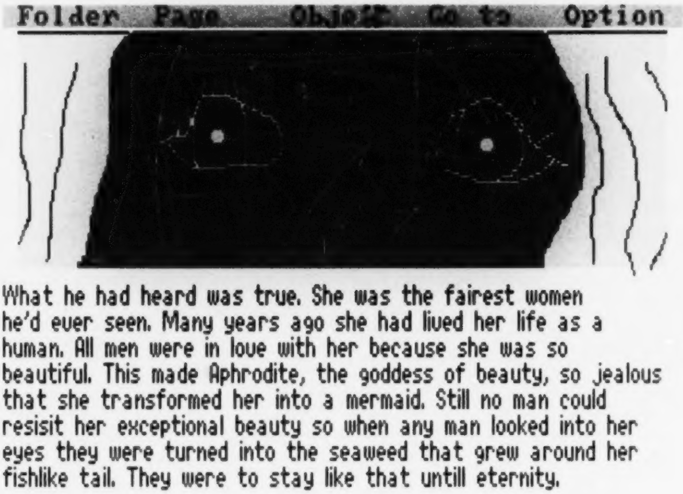
The panel is the fundamental unit of comic art, and as Abbott (1986) notes, it was isolated from its context and enlarged by Roy Lichenstein in the 1960's in a series of paintings which asserted its nature as a graphic form. The borders of the panel define a framed opening which allows the viewer to see the scene beyond. It usually contains written language and drawing, and this combination affects the perception of the reader. Abbott (1986) maintains that the text influences the perception of the panel image and exerts a guiding factor in deducing the picture's meaning.

The notion of a panel in comic art has parallels in the nodes of some hypertext systems. Nielson, (1990), who describes the node as the fundamental unit of hypertext, maintains that although there is no agreement as to what constitutes a node, some systems such as *Hypercard* are based on a frame which is defined as the size of a computer screen. The widespread availability of software such as *Hypercard, Toolbook for Windows, Linkway* and *Storyspace,* means that frame-based hypertext systems may be used by schools for student's story writing.

Several hypertext stories written by the students in the associated study exhibited characteristics often found in comics, such as exaggerated features of characters, or the positioning of objects in a frame. Some students were aware that increasing the size of the picture relative to the text at a critical point in the story would increase the emotional impact of the page on the reader.

A number of conventions have been developed by comic illustrators, which may affect teachers' and students' understanding of how information can be presented in a single frame of hypertext. Eisner (1985) provides illustrations of how a series of facial expressions and postures can become familiar shorthand for readers. The omnipotent narrator can be included in a comic panel, as can speech balloons, thought balloons, and jagged edges which indicate voice or sounds coming from a machine. A frame showing a slim head implies a slim body outside the frame, and the size and the shape of the frame can change to accommodate changing mood or the speed of narrated events.

In the associated study of student hypertext stories with pictures and words, a number of screens produced by the students exhibited similar characteristics. In one example, part of the head of a beautiful woman implies a similar overall appearance, (see figure 1, below)



What he had heard was true. She was the fairest women he'd ever seen. Many years ago she had lived her life as a human. All men were in love with her because she was so beautiful. This made Aphrodite, the goddess of beauty, so jealous that she transformed her into a mermaid. Still no man could resisit her exceptional beauty so when any man looked into her eyes they were turned into the seaweed that grew around her fishlike tail. They were to stay like that untill eternity.

Figure 1: Student hypertext screen, showing comic-panel attributes.

and jagged and wavy lines used as borders of pictures suggests a particular action or state, such as an intention to solve a problem with force, or the dream-state of a protagonist. In another hypertext, reminiscent of the Disney characters in comics, students used the anthropomorphic device of attributing human qualities to an animal character, in a story entitled *Riley the Rhino.*

However, comics are not always simple, and the interaction of image with text can be sophisticated. Witek (1989) notes that some comics do not have the closure which the reader usually expects. Others, instead of paralleling the verbal and visual texts, contrast or even contradict the two. While it is common to believe that comics are suitable only for young children, Carl Barks, an author and illustrator of *Donald Duck* and other comics (Disney, 1978), argued that his work was not "juvenile kid stuff", but a new form of fiction which men and women had first read as children, and then re-read as adults. His evidence was a considerable volume of mail received, not from children, but from lawyers, doctors, writers, artists, professors, sports figures and other adult occupations.

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In a similar way that Nintendo acts as an invisible culture which receives little attention from the adult world despite its accepted part of childhood culture (Provenzo, 1991), comics too may be overlooked by researchers. The investigation by Sachs, Smith and Chant (1990 and 1991) examined adolescents' use of media, including television, radio, books, magazines and newspapers, but failed to ask any questions about readership of comics. Other accepted components of childhood culture may similarly be overlooked, because they have taken place at an earlier time. Although they may be insignificant as a part of students' current reading, their formative influence may be considerable. An example of another such influence may include picture-books.

Picture-books as a parallel to hypertext composition

Adolescents' concepts of how to write a story in school are likely to have been affected by the narrative mediums to which they have been exposed. Many students in Western societies will have become used to reading picture-books, which contains one model of the use of pictures and text. As older school students, these memories may fade, but the experiences may nevertheless be formative in a student's concept of how picture and text can work together. Some students may have younger siblings who still use picture-books regularly. For teachers, the memory may be more distant for some, but others who are parents may still be involved in the use of picture-books on a regular basis. They thus constitute a shared heritage of mutually supportive meaning-making systems, pictures and words, which teachers and students can use to their advantage.

Students use a number of language processes to construct meaning, and Bartelo (1990) argues that teachers need to be more aware that language arts are inter-related, and not isolated. Picture-books are an excellent example of such interrelationships. Picture-books can be used directly in classes with older students, and O'Sullivan (1987) suggests that they can involve readers in thinking about possibilities and probabilities of the story, encourage an emotional response, and demand that students think about the linking of illustration and text. The use of illustrations is seen as valid in the English lesson by O'Sullivan because an appreciation of illustrations involves an understanding of how they change a reader's perception of the text.

Although Lucky (1989, page 290) has labelled pictures the "junk-food of the information age", and Salomon (1984) had earlier insisted that pictures required less mental effort than text, it is clear that some author-illustrators of picture-books have a sophisticated view of how pictures and text complement each other, and, in combination, add a richness to the story.

There is some consensus from writers on this subject (Wagner, 1992; Scott-Mitchell, 1987; Tucker, 1981; Ardizzone 1980; Lorraine 1980;) that illustrations and text in picture-books must be balanced and complementary, but that the pictures should not just simply illustrate the text. This goes beyond leaving out obvious details such as a red dress or blue sky in the text, because it will be obvious in the illustrations. The pictures may be drawn to produce a particular emotional response in combination with the words. The details may also be deliberately left out of the pictures to allow the readers to use their imagination, as Tucker (1981) asserts about the artwork of Ardizzone. Again, as Wagner (1992) suggests, it may be deliberate to have the words saying one thing, and the pictures something else. An example may be seen in Wagner's picture-book story, *John Brown, Rose and the Midnight Cat* (Wagner, 1977), where the pictures provide an interpretation of the story which differs from that offered by the words.

In the study, several hypertexts indicated that students were aware that the pictures could predispose the reader to the words which followed later in the story. One hypertext, was entitled *An Adventure in Giant Land.* (Figure 2)

In the hypertext node shown above from this story, a huge, sinister tree in brooding colours encircles the title on the first page. It establishes a feeling of foreboding, suspense and mystery which the title alone does not hint at. In yet another student hypertext, the writers gradually increased the size of the frames containing the pictures, and the words on screen became correspondingly sparse. This awareness of the relationship between ratios of pictures and words, and the suspense in the story is found in a number of picture-books, and also in comics.

Symbolism and stylised representations of people and objects can be identified in picture-books. Similarly, one pair of students were able to consistently represent their ideas, not as realistic pictures, but as symbols. These signs, such as an oversized question mark, exclamation mark, Christian symbols, a stylised knife and weeping eyes were used effectively with a sparse text to produce a hypertext which was strikingly different from that of their peers.

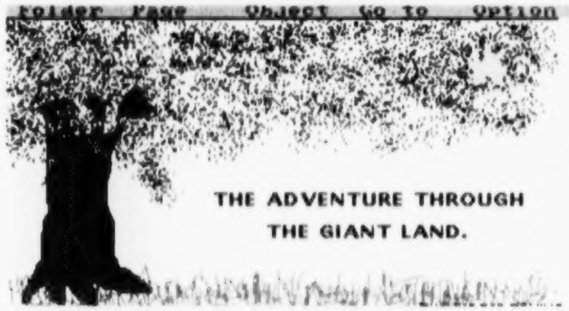

Figure 2: Student hypertext screen showing picture-book attributes

Suggestions from these student examples does indicate an area where pedagogy might inform future work. Without an appropriate body of knowledge or adequate models, teachers may implement a sophisticated process to assist students in the construction of hypertexts with words, but leave students to their own devices in the way in which pictures work with words in texts to produce meanings. Some students may be unaware that anything other than simple illustration is possible. Others may develop an awareness of some of the positive and negative aspects of writing hypertext composition with pictures and words. As one student in the study explained it,

I reckon I like writing the story on the computer...but actually drawing the pictures is harder. But it's more interesting to read, you have more variety, more adventures, like instead of just reading the words you have choices and pictures.

Conclusion

This paper has argued that hypertext software permits students to produce stories which include pictures and words. The characteristics of such stories may be affected by student and teacher understandings of how pictures and words can be combined to produce meanings for the reader. Comic books and picture-books contribute to a shared cultural experience. This experience adds to a body of theory which may be applied to hypertext and conventional stories, and provides a modelling effect which influences the nature of what is written. Conclusions in this paper have been supported by data from a group of students who wrote hypertext stories with pictures and words. The increasing need for teachers to consider the addition of pictures to their pedagogy of story-writing means that some teachers will choose to modify the ways in which they teach. When this happens, it would be wise to have a pedagogy in place. As Eldred (1991) reminds us, technology is not neutral. To hope for it to just fall into place is to play Russian roulette with the effectiveness of our classrooms.

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References:

Abbott, L., (1986) Comic Art: Characteristics and Potentialities of a Narrative Medium. *Journal of Popular Culture*, no 19 (Spring) pp 155-173.

Ardizzone, E., (1980) Creation of a Picture Book. In S. Egoff, G. Stubbs, and L. Ashley, *Only Connect: Readings on Children's Literature.* Ontario, Oxford University Press.

Bartelo, D., (1990) The Linkages across Listening, Speaking, Reading, Drawing and Writing. *Reading Improvement* no 27, pp 162-172.

Bush, V., (1945) As we May Think. *Atlantic Monthly,* 176 (1), 101-106.

Breen, M., Louden, W., Barrat-Pugh, C., Rivalland, J., Rohl, M., Rhydwen, M., Lloyd, S., and Carr, T., (1994) *Literacy in its Place: Literary Practices in Urban and Rural Communities — Overview and Interpretations.* Canberra, Department of Employment, Education and Training.

Carroll, L., (1988 edn) *Alice's Adventures in Wonderland.* Leicester, Galley Press.

Disney, W., (1978) *Donald Duck.* New York, Abbeville Press. .

Eisner, W., (1985) *Comics and Sequential Art.* Tamarac, Florida, Poorhouse Press.

Eldred, J., (1991) Pedagogy in the Computer-Networked Classroom. *Computers and Composition,* 8 (2), 47-61.

Kearney, R., (1988) *The Wake of Imagination: Ideas of Creativity in Western Culture.* London, Hutchinson.

Lorraine, W., (1980) An Interview with Maurice Sendak. In S. Egoff, G. Stubbs,, and L. Ashley (eds) *Only Connect: Readings on Children's Literature.* Ontario, Oxford University Press.

Lucky, R., (1989) *Silicon Dreams: Information, Men and Machine.* New York, St Martin's Press.

Nelson, T., (1982) A New Home for the Mind. *Datamation,* 28 (3), 169-180.

Nelson, T., (1987) *Computer Lib: Dream Machines* Redmond, Washington, Tempus Books (Microsoft Press).

Nielson, J., (1990) *Hypertext and Hypermedia.* San Diego, Academic Press.

O'Sullivan, C., (1987) *The Challenge of Picture Books: A Teacher's Guide to the Use of Picture Books with Older Students.* North Ryde, Methuen Australia.

Provenzo, E., Jr. (1991) *Video Kids: Making Sense of Nintendo.* Cambridge, Massachusetts, Harvard University Press.

Reitberger, R., and Fuchs, W., (1972) *Comics: Anatomy of a Mass Medium.* London, Studio Vista.

Sachs, J., Smith, R., and Chant, D., (1990) Bombarding the Senses: Adolescents' Use of Information Technology in Australia and Scotland. *Metro Media and Education Magazine* no 82, pp 2-6.

Sachs, J., Smith, R., and Chant, D., (1991) How Adolescents use the Media. *Youth Studies,* 10 (2), 16-19.

Salomon, G., (1984) Television is "Easy" and Print is "Tough": The Differential Investment of Mental Effort in Learning as a Function of Perceptions and Attributions. *Journal of Educational Psychology,* 76 (4), 647-658.

Scott-Mitchell, C., (1987) Further Flight: The Picture-Book. In M. Saxby, and G. Winch, (eds) *Give Them Wings: The Experience of Children's Literature.* South Melbourne, MacMillan.

Tucker, N., (1981) *The child and the Book: a psychological and literary exploration.* Cambridge, Cambridge University Press.

Wagner, J., (1977) *John Brown, Rose and the Midnight Cat.* London, Penguin Books.

Wagner, J., (1992) *On Writing Books for Children.* St Leonard's, Allen and Unwin.

Waugh, Coulton (1947) *The Comics.* Jackson, University Press of Mississippi.

Witek, J., (1989) *Comic Books as History: The Narrative Art of Jack Jackson, Art Spiegelman and Harvey Pekar.* Jackson, University Press of Mississippi.

Automatization of Student Assessment Using Multimedia Technology

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Most use of multimedia technology in teaching and learning to date has emphasised the teaching aspect only. An application of multimedia in examinations has been neglected. In this paper, we present a prototype of multimedia question bank, which is able to handle questions consisting not only text but also images, video recordings, etc. We also describe retrieval techniques, and show some sample results.

Introduction

As multimedia technology has become more available, the benefits of using this technology in teaching and learning become more visible. Multimedia is often referred to as a combination of different medium (eg, images, graphs, audio, video) used in a software application (Christodoulakis and Koveos, 1995, Grosky, 1994). Incorporating these media in computer-based tutorials (CBT), one of the devices in educational technology, results in a much more flexible and interesting learning process. However, most of these tutorials concentrate on the delivery of the lesson only. Assessment, which is another part of teaching process, is often neglected. The use of multimedia technology in this area has not been considered in depth. In this paper, we would like to address how multimedia technology can be applied to the automatization of assessment.

One issue in automatization of student assessment is the availability of question banks. Multimedia question banks typically consist of questions with multimedia features. This means that the questions can be presented not only in text, but also in any other forms, eg, images, video. Furthermore, some questions can be grouped and they refer to a common object (ie, image, video). For example, in the database there are ten questions which are based on the same video recording. A major problem arises when only a few of these questions are selected. A decision must be made whether to present the object as a whole or only parts of the object which directly relate to the questions. If the object is large, such as a video recording of 30 minutes, and only two or three questions are selected from this recording, it would be wiser if only relevant segments of the recording are played. Presenting the whole recording will not only distract, but also confuse examinees.

Choosing which part(s) of the object to accompany the selected questions has become a non-trivial task. Our approach is to use the object-oriented technology which provides a feature of message passing from one object to another. In this way, the selected questions only need to send a message to the object, and let the relevant object partition and construct the segments to be presented together with the questions. This technique works because an object is stored as an aggregate of its components, not as an unbreakable unit. Our previous work (Taniar and Rahayu, 1995) discussed the storage and retrieval techniques of multimedia questions in great detail.

In this paper, we would like to present a prototype of a multimedia question bank. The rest of this paper is organised as follows. Section 2 describes the structure of multimedia questions. Section 3 explains how to retrieve questions from the database. Section 4 presents some sample results, and finally, Section 5 gives a conclusion.

The Structure of Multimedia Questions

The two main parts of multimedia questions are *object* and *question parts*. Figure 1 shows a typical multimedia question. In the context of object-orientation, "object part" should not be confused with "object". Object part contains a "thing", which can be of any form, ie., image, graphs, recording, text (Taniar and Rahayu, 1995). In contrast, the term "object" in the object-oriented paradigm refers to an instance of a class (Dillon and Tan, 1993, Taniar, 1992).

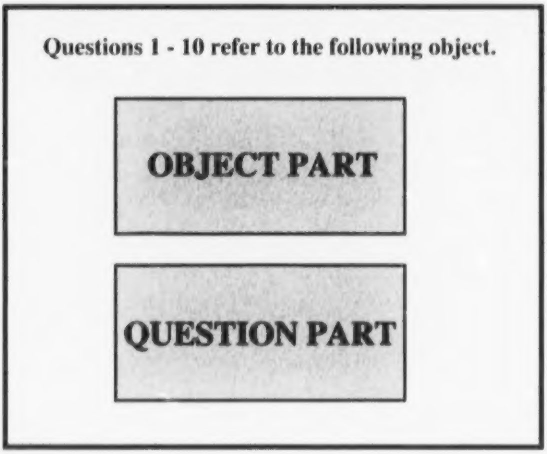


Figure 1. Multimedia Questions

Object Part

The object is the main focus to which questions in the question part refer. These objects can be either:

- *temporal* or
- *spatial* objects.

Temporal objects are objects that span a linear dimension. An example of a temporal object is a recording of any type, such as audio, visual. These objects fill a single dimensional space which is the duration of the play. A key feature of this kind of object is that there is a starting point and an ending point.

Spatial objects are static. They can be presented on x and y axis, or columns and rows. Some examples include images, graphics, text, etc. When the object does not fit into the provided space, a scroll bar is shown to enable users to scroll the object.

Question Part

The *question part* consists of a set of questions referring to an object. The questions can be either:

- single point or
- multi point questions.

A *single point* question is a question which has a reference to a single segment of an object. If the object is a temporal object, single point questions relate to a "moment" of the play. The "moment" can be interpreted as a section that cannot be divided into more sections. The question could be a question on what was said, or where it took place, etc. If the object is a spatial object, single point questions refer to a section of an image/picture. For example, a question can be asked about a part of an engine, or a block of a landscape.

Multi point questions have reference to several sections of an object. The referred sections can be in *serial* or at *random*. Serial multi point questions associate with a series of adjacent sections. If it is in a temporal object, the sections are contiguous. However, in a spatial object, adjacent sections can be clustered based on columns or rows. On the other hand, random multi point questions link with several sections of an object in random order. In an extreme case, a question refers to the starting point and ending point of a recording. Therefore, when this question is selected, all parts of the recording must be played. This similar technique applies to spatial objects as well.

Some Examples

Figure 2 shows an example of questions with a spatial object. The object is a music score of Beethoven Symphony No. 5. Since the music score is very long, a scroll bar is provided at the bottom. The questions related to this object can be viewed by pressing the "Question" button.

If the music is played, rather than displayed, the object becomes a temporal object. Figure 3 shows an example of a temporal object. The object itself is a video recording of an orchestra playing Beethoven Symphony No. 5. It is not possible to represent temporal objects on paper. Rather a moment of the recording is shown, where the orchestra is in action. The questions, which will be viewed by clicking the "Question" button, are suitable to test the listening comprehension of students studying at a conservatorium of music.

Retrieval Techniques

Question retrieval should be two-directional, ie. from the object parts or from the question parts. As a result, searching techniques should facilitate both object based and question based retrieval.

Object Based Retrieval

Content based searching of multimedia objects is considered immature as current video and audio management tools are based on pixel rather than the perceived contents (Smoliar and Zhang, 1994). Current research in the areas of image and pattern recognition is addressing this problem, and therefore is excluded from our implementation.

In our prototype, each object part has a set of properties, ie., title, topic. Users are able to do a search based on information contained in these properties. Figure 4 shows an example of question retrieval based on objects. In this example, the user is able to search an object on a particular title. Once the object is found, all related questions will also be retrieved.

If the number of objects in the database is small, searching can be done through a complete browsing of all objects. Once the objects are selected, the associated questions are then presented and chosen, as associated questions have been implemented as an aggregate of the object parts. Therefore, each object has a number of corresponding questions. Figure 5 shows a number of objects to be manually selected by double clicking a desired object. The title of the object itself appears at the top of each object.

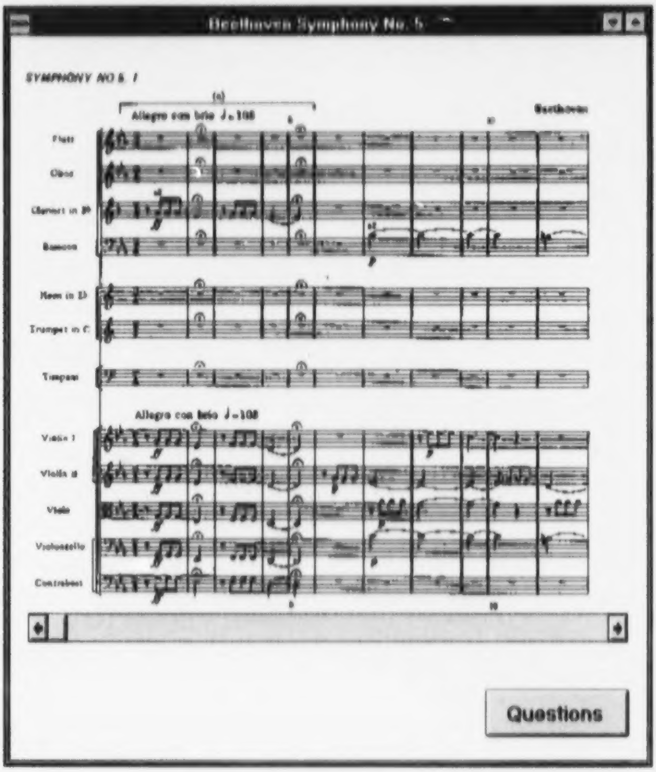

Beethoven Symphony No. 5
SYMPHONY NO 5. I
Allegro con brio
Beethoven
Flute
Oboe
Clarinet in B♭
Bassoon
Horn in E♭
Trumpet in C
Timpani
Allegro con brio
Violin I
Violin II
Viola
Violoncello
Contrabass
Questions

Figure 2. Spatial Object — music score

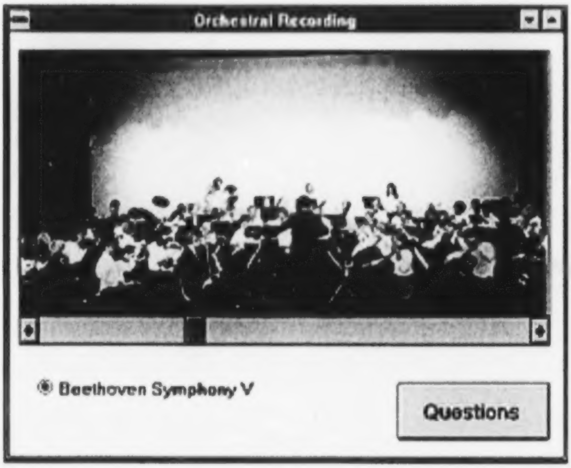

Orchestral Recording
● Beethoven Symphony V
Questions

Figure 3. Temporal Object — music recording

BEST COPY AVAILABLE

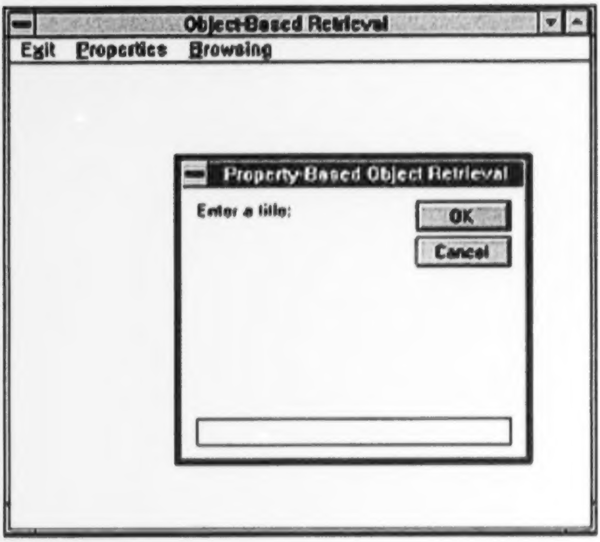

Object-Based Retrieval
Exit
Properties
Browsing
Property Based Object Retrieval
Enter a title:
OK
Cancel

Figure 4. Property based object retrieval

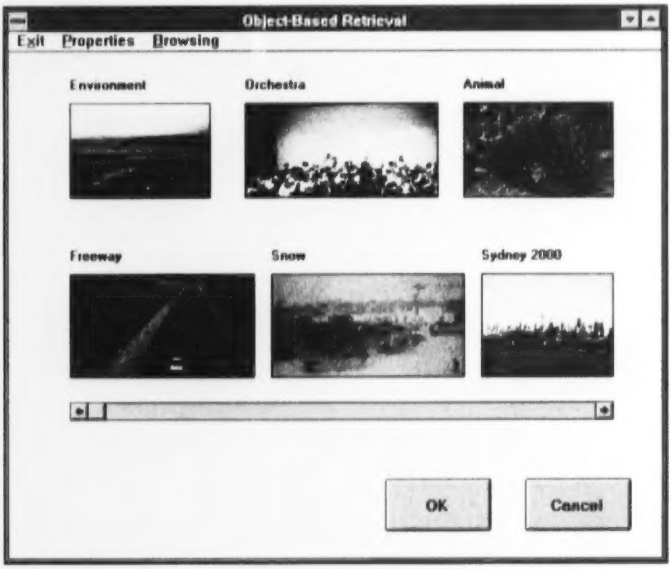

Object-Based Retrieval
Exit
Properties
Browsing
Environment
Orchestra
Animal
Freeway
Snow
Sydney 2000
OK
Cancel

Figure 5. Object browsing

Question Based Retrieval

Selecting questions from a database can be done through a query facility within the database, which retrieves questions satisfying the selection criteria. This selection can be done through keywords or subject matching. At this stage of the implementation, content based searching for questions is not possible. Figure 6 shows a property based question retrieval. The user has to enter the subject of questions to be retrieved.

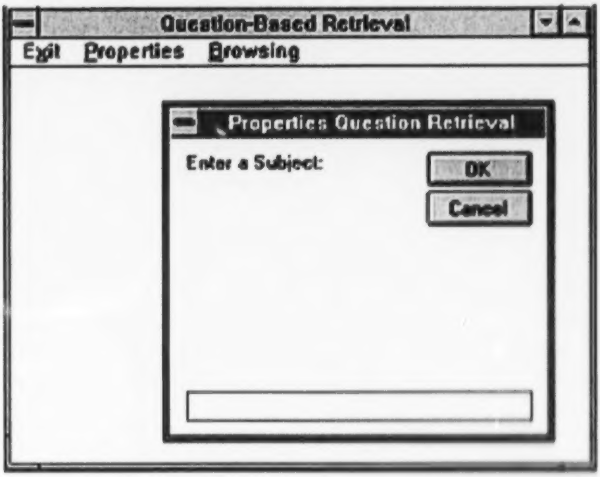

Question-Based Retrieval
Exit
Properties
Browsing
Properties Question Retrieval
Enter a Subject:
OK
Cancel

Figure 6. Property based question retrieval

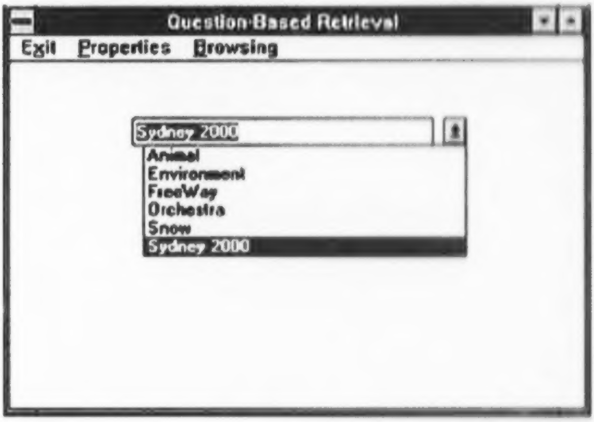

Question-Based Retrieval
Exit
Properties
Browsing
Sydney 2000
Animal
Environment
FreeWay
Orchestra
Snow
Sydney 2000

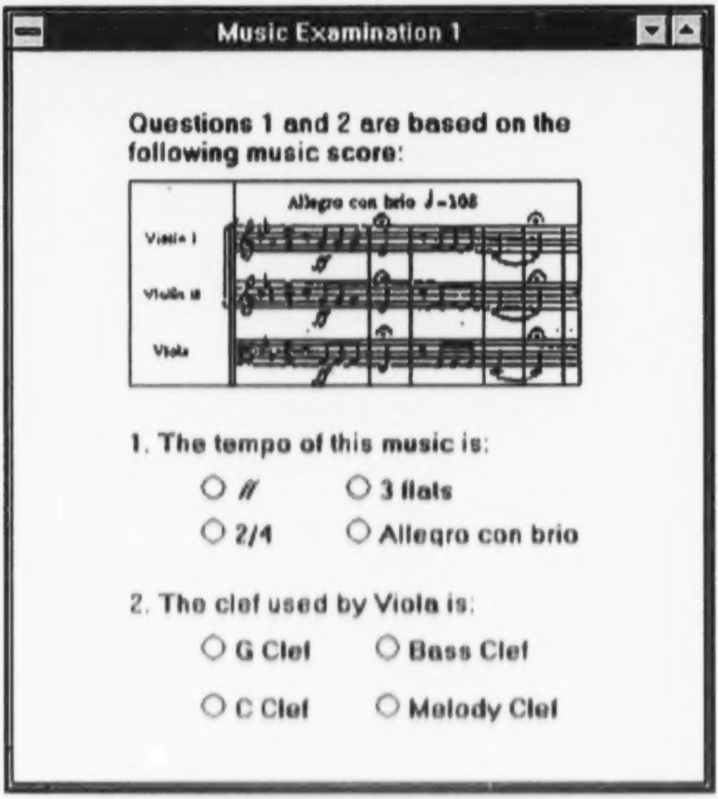
Figure 7. Questions browsing

Another retrieval technique is based on database browsing. Users are presented with a complete list of questions in the database. The user can select a particular topic, and then within each topic, the questions can further be selected and chosen. This technique will be very useful when combined with the object-based retrieval, as the object based searching lists an object. Based on the selected object, a number of questions can be chosen either manually or randomly. Figure 7 shows an example of question browsing retrieval technique. Once the questions are selected, the accompanying objects are also retrieved. This mechanism is possible because each question is attached to an object.

Sample Results

Some retrieval results are presented as follows. Figure 8 shows an example of the result of multi point serial questions. The object presented shows a string part only (not a full orchestral part). Question 1 refers to the tempo of the music. The tempo is usually displayed at the beginning of a section. As the section concerned is the first movement of the symphony, only the very first few bars are displayed. Question 2 refers to the clef used by a particular instrument (ie., viola). Combining questions 1 and 2, only the first few bars of the symphony, which also include the viola part, are displayed.

Figure 9 shows an example of multi point random questions. Question 3 refers to the instruments playing on the few first bars on the symphony (in this case, they are Clarinet, Violin 1 and 2, Viola, Cello, and Double Bass). Question 4 refers to the Clarinet and Violin 1 sections. Both questions 3 and 4 are multi point random questions, because they refer to two or more different types of instrument which are not adjacent.



Questions 1 and 2 are based on the following music score:

1. The tempo of this music is:

○ ff ○ 3 flats

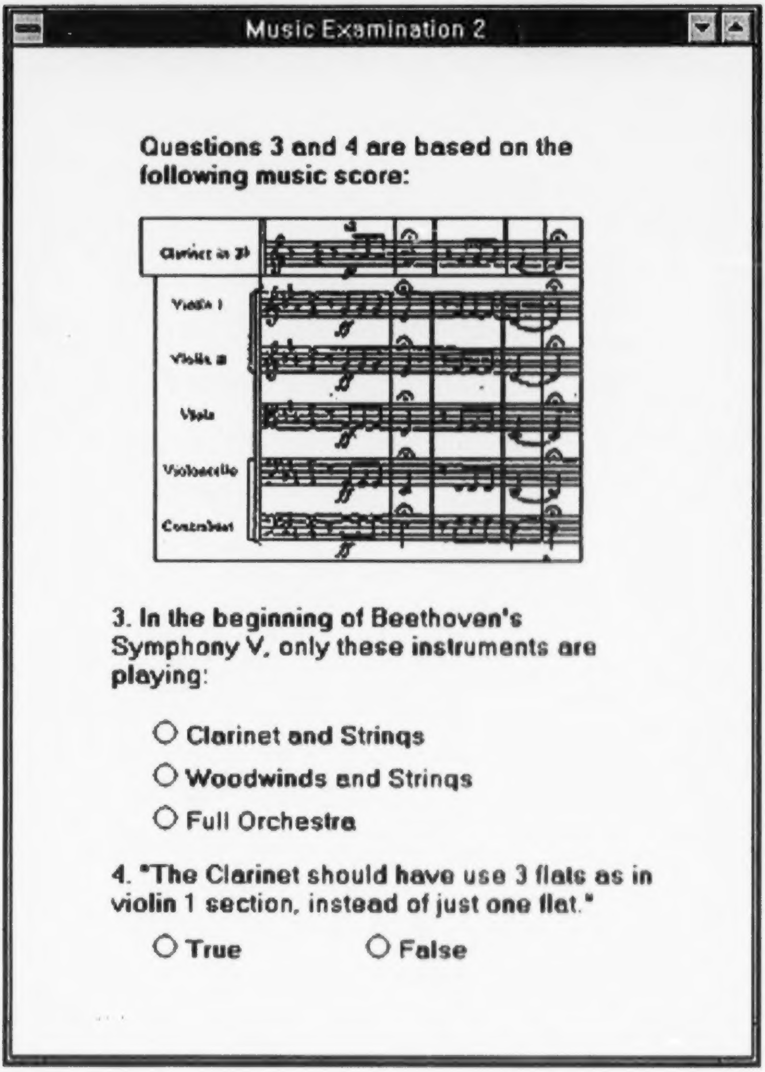
○ 2/4 ○ Allegro con brio

2. The clef used by Viola is:

○ G Clef ○ Bass Clef

○ C Clef ○ Melody Clef

Figure 8. Multi point serial questions



Questions 3 and 4 are based on the following music score:

3. In the beginning of Beethoven's Symphony V, only these instruments are playing:

○ **Clarinet and Strings**

○ **Woodwinds and Strings**

○ **Full Orchestra**

4. "The Clarinet should have use 3 flats as in violin 1 section, instead of just one flat."

○ **True** ○ **False**

Figure 9. Multi point random questions

Conclusion

A prototype of a multimedia question bank has been presented in this paper. The type of question that we concentrate on is an object referred to by several questions. Retrieving some of the questions can be very tricky because not all parts of the objects are concerned. Our system is able to select parts of the object which must be presented with the questions.

Future work includes finalizing technical details of the system. It is also planned to have a usability testing of the system when available.

References

Christodoulakis, S, and Koveos, L. (1995). Multimedia Information Systems: Issues and Approaches, *Modern Database Systems: The Object Model, Interoperability, and Beyond*, W. Kim (ed), Addison-Wesley, ACM Press.

Dillon, T., and Tan, P-L. (1993). *Object-Oriented Conceptual Modeling*, Prentice Hall of Australia Pty Ltd.

Gemmell, D.J, Vin, H.M., Kandlur, D.D., Rangan, P.V, and Rowe, L.A. (1995). Multimedia Storage Servers: A Tutorial, *IEEE Computer*, May 1995, IEEE Computer Society.

Grosky, W.I. (1994). Multimedia Information Systems, *IEEE Multimedia*, Spring 1994, IEEE Computer Society.

Rahayu, J.W, and Chang, E. (1993). A Methodology for Transforming an Object-Oriented Data Model to a Relational Model, *Proceedings of the Twelfth International Conference TOOLS Pacific*, Melbourne.

Rahayu, W., Chang, E., and Dillon, T.S. (1995a). A Methodology for the Design of Relational Databases from Object-Oriented Conceptual Models Incorporating Collection Types, *Proceedings of the TOOLS18 Pacific*, Melbourne.

Rahayu, W., Chang, E., and Dillon, T.S. (1995b). Transformation of Object-Oriented Collection Types into Relational Logical Models, *Industrial and Poster Paper Proceedings of the 14th International Conference on Object-Oriented and Entity-Relationship Modelling*, Gold Coast.

Smoliar, S.W., and Zhang, H-J. (1994). Content-Based Video Indexing and Retrieval, *IEEE Multimedia*, Summer 1994, IEEE Computer Society.

Taniar, D. (1992). Unifying Object-Oriented Features with Database Technology: A Survey, *Masters Thesis*, Swinburne University of Technology, Melbourne.

Taniar, D., and Rahayu, W. (1995). Multimedia Question Banks: Storage and Retrieval Techniques, *Proceedings of the Twelfth Annual Conference of the Australian Society for Computers in Learning in Tertiary Education ASCILITE'95*, Melbourne.

Perspectives on the place of educational theory in multimedia

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A number of themes and issues emerge in any discussion about educational theory, learning and instruction. Interactive multimedia provides another vehicle to consider and reconsider the place of educational theory, and particularly theories centred on student learning, in the design of multimedia. What follows in this paper, is a discussion of some of the prevalent issues that emerged as part of the Educational Theory strand to the Mini–conference for Practitioners of Educational Interactive Multimedia (Curtin University, 7–9 July, 1995). The paper also reflects issues related to a similar debate being had more widely amongst developers and users of interactive multimedia, a debate particularly evident from time to time, on IT–FORUM.*

Invariably, we need to look towards educational theories to engage and underpin approaches to instructional design. To what extent, however, should a given instructional approach reflect a holistic and integral view or theory of student learning? Is it appropriate, for example, to approach the design process eclectically, using a mixed bag of theories or frameworks to rationalise a particular instructional design? Whatever the answers to these ever–present questions, there are a number of theoretical frameworks that deserve particular attention in this context. Some of these are considered below.

What is meant by 'learning'?

In the context of this paper, learning it is suggested, should be seen in terms of cognitive change. That is not to suggest that other learning of an affective or psychomotor sort is not of importance, or that interactive multimedia does not provide for such learning—but rather, in tertiary contexts at least, cognitive development in learners is perhaps the central aim of most instruction. Furthermore, Laurillard (1993) describes the academic knowledge necessary to cognitive development in domains studied at tertiary level, as being different to other levels or types of knowledge, particularly everyday knowledge. That is, learning at tertiary level necessarily includes not only learning knowledge in real–world contexts (experiential learning) but also learning others' descriptions of the world (academic learning) (Saljo, 1984).

The learner

We probably need to account for two important and different considerations here: the learner's style as well as their approach to learning. Learning styles and learning approaches represent two different perspectives on student learning processes, each of which appear to influence academic achievement (Murray–Harvey, 1994). Also, both are conceptualisations that provide a framework for understanding how students learn and why there are differences between students' learning, in terms of learning outcomes.

Broadly speaking, the theory underpinning measurement of learning styles is that students possess biologically determined learning preferences in respect of environmental, emotional, sociological, physical and psychological conditions (Price, Dunn, & Dunn, 1991). Varying preferences for each of these learning conditions, combine to provide an individual learning style profile. In addition, since preferences are largely biologically determined, a learner's learning style will necessarily be resistant to change, implying that instruction needs to take account of learning styles rather than trying to change them (Murray–Harvey, 1994).

In stark contrast to this conceptualisation, Biggs (1987a, 1987b) suggests that the process of learning is determined by students' approaches to learning—that is, a composite of students' motives and strategies (to learn) as well as their perceptions of tasks. Importantly, different approaches to learning (and their are four prime approaches: surface, achieving, deep and deep–achieving), are open to change and development, according to changes in motives, strategies and task perceptions (Biggs, 1987a; Biggs, 1987b). Furthermore, it is contended that deep and deep–achieving approaches to learning are more likely to result in better learning outcomes; and as such, instruction should be provided to encourage students to develop these approaches to learning.

Context and situation

It is often argued that context and situation are all important in providing for learning at all levels, and should influence in particular, the design of instructional multimedia (Herrington & Oliver, 1995). Collins (1989) describes situated learning thus, 'situated learning is the notion of learning knowledge and skills in contexts that reflect the way the knowledge will be useful in real life' (p2). In the same context, Collins, Brown and Newman (1987) argue strongly for the effectiveness of cognitive apprenticeship models of pedagogy, where, it is suggested, 'teaching methods should be designed to give students the opportunity to observe, engage in, and invent or discover expert strategies in context' so that they might best learn both cognitive and metacognitive skills' (p12).

It is not clear, however, that the concept of situated learning allows for the levels of abstraction required for understanding in many domains of knowledge, particularly those studied by university students. For example, Laurillard argues cogently that learning in situated contexts does not, by itself, allow for a learner to make abstractions from the particular context and therefore be able to generalise or even be able to apply what is learnt to new situations or contexts (Laurillard, 1993). This has, in particular, an important implication for learning what Laurillard classifies as 'academic knowledge'—she considers academic knowledge to be different to everyday knowledge, drawing a distinction between learning 'percepts' in everyday life and learning 'precepts' in education, implying that learning precepts necessitates students building understanding in a deeper (abstract) sense, a level of understanding which cannot be provided for simply by situating the learning experience (Laurillard, 1993, 23–29).

A note on constructionism

We should probably not resist the temptation to comment upon the nature and role of constructivism in a discussion of issues related to educational theory, learning and multimedia (particularly since constructivism is often misconstrued and misrepresented). There are a whole range of theories concerned with the way in which students learn which together inform what is usually meant by 'constructivism'; some theories emanate from a cognitivist tradition, others from a social psychological, interactionist or experiential perspective (and the list could go on). However, in much of the current and recurring debate about the role of educational and learning theory in instructional technologies (especially multimedia), there seems to be a readiness to polarise one theory of learning (behaviourism) with a metatheory (constructivism), and, further, to present the former as grossly deficient and the latter as the only credible explanation of student learning.

The difficulty here is that such a polarisation is entirely philosophical, and as such represents fundamentally different views on what is meant by knowing, the role of education and the nature of learning. The polarisation, outside of a philosophical debate, is certainly not helpful in determining effective instructional design. For example, even although the main components of behaviourism (or at least the behavioural theory of Skinner) were largely discredited as general truths in the 1970s, the principles of contiguity, repetition, reinforcement through feedback and motivation are still recognised as important in processes of learning (Entwistle, 1987). Indeed, there are various dimensions in different theories of learning, and not all fit along an imaginary continuum connecting two supposed extremes—this is where Reeves' work on the evaluation of instructional technologies is misleading (Reeves, 1994). If we need a metaphor to represent learning or educational theories as a whole, a series of corresponding and opposing objects, each with its own attributes, some common, some unique, is ultimately a more accurate and useful metaphor than a simple, linear path connecting two poles or extremes.

Perhaps the overriding point is that, in designing and evaluating interactive multimedia we must be prepared to refer to explanations of student learning to describe the most appropriate way of addressing a particular learning situation. Also, that all theories or explanations of learning, be they psychometric, humanistic or behaviouristic, are each credible in helping to understand certain kinds of learning; but that each theory is also partial in that it refers to a limited range of learning situations and that it is often based on a limited set of data.

Conditions of learning

From the phenomenographical research of Marton (Marton, Hounsell, & Entwistle, 1984; Marton & Ramsden, 1988), Saljo (1984) and Thomas and Harri–Augustein (1985), it is useful to consider the notion of the ultimacy of individuality in learning, that learning is different for individual learners; and that learning involves a negotiation of meaning (in the form of conversation), within and between learners, which leads to understanding. To describe what is successful in learning, in this context, is to describe successful interactions between learner, context and instruction. Thus, it is not possible to distil from such interactions a set of prescriptive conditions of learning, since the interactions that might be described will be rooted in a particular context and therefore are likely to be context specific and non–generalisable.

Given this premise, if we take it as so, how is it possible to reconcile an approach to instructional design that strives to describe the necessary conditions of learning for all learners and for all learning situations? Well, quite simply, it isn't. However, for instructional technologies at least, the influence of Gagne's *The Conditions of Learning* (Gagne, 1977), and more lately, Merrill's work (Gagne & Merrill, 1990), continues to have a tremendous impact on instructional design, particularly for instructional multimedia—Laurillard describes both as 'key figures in instructional design' (Laurillard, 1993). Merrill has even purported to have computerised this approach to instructional design (Merrill, Li, & Jones, 1990).

In fact, Merrill has recently published a defence and rationalisation of instructional design as a science, against the encroachments of what he terms, 'those persons who claim that knowledge is founded on collaboration rather than empirical science, or who claim that all truth is relative...' (Merrill, et al., 1996). In this recent work, he makes a number of crucial points, attempting to re–establish the authority of an instructivist and philosophically uncompromising approach to instructional design:

- There are known instructional strategies. The acquisition of different types of knowledge and skill require different conditions for learning (Gagne, 1977). If an instructional experience or environment does not include the instructional strategies required for the acquisition of the desired knowledge or skill, then effective, efficient, and appealing learning of the desired outcome will not occur.
- These instructional strategies (conditions of learning) can be verified by empirical test.
- Appropriate instructional strategies can be discovered, they are not arrived at by collaborative agreement among instructional designers or learners. They are based on natural principles which do exist, and which nature will reveal as a result of careful scientific inquiry.
- Many persons associated with educational technology today are engaged in a flight from science. Instructional design is a scientific and technological field. It is not merely philosophy; it is not a set of procedures arrived at by collaboration; it is a set of scientific principles and a technology for implementing these principles in the development of instructional experiences and environments.

Cognitive tools

One way of embracing the findings of phenomenography and using these to provide for new models of instructional design, is to consider the role of the computer as a cognitive tool; that is, to conceptualise the computer as tool to engage the learner in interactions—principally with their own meanings or understandings, as well as those of others, in order to build a more complete, richer, understanding. The notion of computers as cognitive tools is not new (it's certainly as old as educational computing itself), and it has a theoretical base in mental models theory. Johnson–Laird (1983) explains mental models thus:

> Understanding certainly depends on knowledge and belief. If you know what causes a phenomenon, what results from it, how to influence, control, initiate, or prevent it, how it relates to other states of affairs or how it resembles them, how to predict its onset and course, what its internal or underlying 'structure' is, then to some extent you understand it. The psychological core of understanding, I shall assume, consists in your having a 'working model' of the phenomenon in your mind. If you understand inflation, a mathematical proof, the way a computer works, DNA or a divorce, then you have a mental representation that serves as a model of an entity in much the same way as, say, a clock functions as a model of the earth's rotation. (p2)

By providing interactive and perhaps multimedia environments on the computer, which are able to accommodate learners' representations or models of conceptual phenomena and allow for predictions, explanations and simulations, then we are providing the means by which learners can represent, explicitly, their own understandings, interact with others' (teacher's or students') representations and come to understand a range of conceptual meanings in relation to their own. The computer, in the shape of a cognitive tool, allows the learner to externalise their thinking, to enrich it, manipulate it and change it, all by interacting with one or more conceptual models on the computer, in the form of a dialogue (whether that dialogue is real and conducted with others, or whether it occurs in the learner's head).

Thus, instead of designing instruction in the form of predetermined instructional goals, each matched with an artificially constructed learning event (Gagné, 1977), it is possible to enable the learners themselves to design by expressing their representations or models of understanding, and by doing so, engage in meaningful cognitive interactions. Jonassen and Reeves describe this process thus:

> Instead of specialists such as instructional designers using technology to constrain students' learning processes through proscribed communications and interactions, the technologies are taken away from the specialists and given to the learners to use as media for representing and expressing what they know. (Jonassen & Reeves, in press)

Jonassen and Reeves (in press), limit their view of what constitutes a cognitive tool on the computer. However, for the computer to act as a cognitive tool, it is important, in terms of mental models theory, simply to allow for the building of computer models, which are beneficial to the processes necessary in constructing accurate and appropriate mental models (Wild, 1996).

Conclusion

So, what is the place of educational theory in interactive multimedia and more particularly, in instructional design for multimedia? Are there guidelines that can be drawn for the implementation of multimedia for effective instruction? Well, yes there are, for some people, in some contexts—but they will be different, depending upon one's views of epistemology, not to mention the nature and context of the instructional situation. For some, it is relatively easy to provide a set of guidelines for effective instruction—and this has been done already, for different types of learning (e.g. for the acquisition of verbal information, intellectual skills, cognitive strategies and attitudes), by Gagne and Merrill, amongst others. For others, it is impossible to provide a set of *guidelines* for effective instructional multimedia—but it is possible to describe the types of 'conversations' or 'interactions' between instructor and learning, that contribute to, and even define, the learning process (in this case, the emphasis being upon a negotiation of understandings and meanings).

In a final comment, it is perhaps sobering to remember that multimedia, as a technology, imposes a set of restrictions upon learning—as well as some opportunities. These restrictions are not always present in more traditional instructional contexts and we should perhaps consider that multimedia is not an ideal medium for all types of instruction—it does not, for example, represent conversation, dialogue or negotiation very well, as learning processes.

References

Biggs, J. B. (1987a). *Student approaches to learning and studying*. Hawthorn, Victoria: Australian Council for Educational Research.

Biggs, J. B. (1987b). *The study process questionnaire (SPQ) manual*. Hawthorn, Victoria: Australian Council for Educational Research.

Collins, A. (1989). *Cognitive apprenticeship and instructional technology* (Technical Report No. 474). BBN Laboratories, Cambridge, MA. Centre for the Study of Reading, University of Illinois. July, 1989.

Collins, A., Brown, J. S., & Newman, S. E. (1987). *Cognitive apprenticeship: Teaching the craft of reading, writing and mathematics* (Technical Report No. 403). BBN Laboratories, Cambridge, MA. Centre for the Study of Reading, University of Illinois. January, 1987.

Entwistle, N. (1987). *Understanding classroom learning*. Sevenoaks: Hodder and Stoughton Educational.

Gagne, R. M. (1977). *The conditions of learning*. New York: Holt Rhinehart and Winston.

Gagne, R. M., & Merrill, M. D. (1990). Integrative goals for instructional design. *Educational Technology Research and Development, 38*(1), 23–30.

Herrington, J., & Oliver, R. (1995). What situated learning tells us about the design of multimedia. In R. Oliver & M. Wild (Eds.), *Learning without limits: Proceedings of the Australian Computers in Education Conference, 1995, Volume 1* (pp. 177–186). Perth, WA: Educational Computing Association of Western Australia.

Johnson–Laird, P. N. (1983). *Mental models: towards a cognitive science of language, inference and consciousness*. Cambridge: Cambridge University Press.

Jonassen, D. H., & Reeves, T. C. (in press). Learning with technology: Using computers as cognitive tools. In D. H. Jonassen (Ed.), *Handbook of research on educational communications and technology* New York: Scholastic Press in collaboration with the Association for Educational Communications and Technology.

Laurillard, D. (1993). *Rethinking university teaching: a framework for the effective use of educational technology*. London: Routledge.

Marton, F., Hounsell, D. J., & Entwistle, N. J. (1984). *The experience of learning*. Edinburgh: Scottish Academic Press.

Marton, F., & Ramsden, P. (1988). What does it take to improve learning? In P. Ramsden (Ed.), *Improving learning: New perspectives* London: Kogan Page.

Merrill, D., Drake, L., Lacy, M. J., & Pratt, J. (1996). *Reclaiming the discipline of instructional design.* Available, LISTSERV@UGA.CC.UGA [on–line]. IT–FORUM, 19 February, 1996.

Merrill, M. D., Li, Z., & Jones, M. K. (1990). Second generation instructional design (ID2). *Educational Technology, 30*(2), 7–14.

Murray–Harvey, R. (1994). Learning styles and approaches to learning: Distinguishing between concepts and instruments. *British Journal of Educational Pyschology, 64*(3), 373–388.

Price, G. E., Dunn, R., & Dunn, K. (1991). *Productivity environmental preference survey (PEPS manual).* Lawrence, KA: Price Systems Incorporated.

Reeves, T. (1994). Evaluating what really matters in computer based education. In M. Wild & D. Kirkpatrick (Eds.), *Computer education: New perspectives* (pp. 219–246). Perth, WA: MASTEC, Edith Cowan University.

Saljo, R. (1984). Learning from reading. In F. Marton, D. J. Hounsell, & N. J. Entwistle (Eds.), *The experience of learning* Edinburgh: Scottish Academic Press.

Thomas, L., & Harri–Augustein, S. (1985). *Self–organised learning*. London: Routledge and Kegan Paul.

Wild, M. (1996). Mental models and computer modelling. *Journal of Computer Assisted Learning, 12*(1), 10–21.

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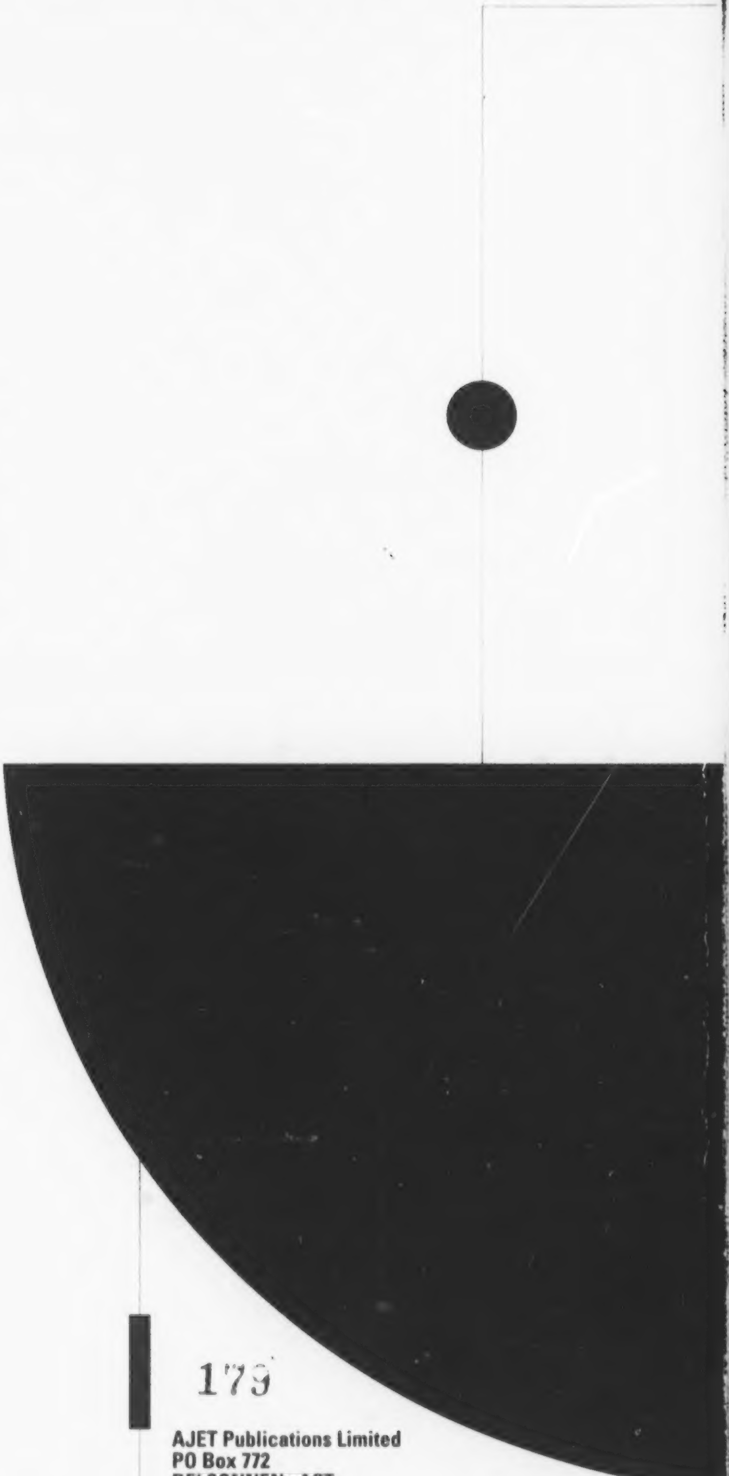

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